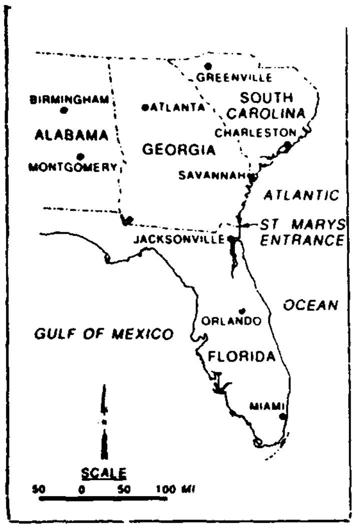
US Army Corps of Engineers

TECHNICAL REPORT HL-91-4

CUMBERLAND SOUND MONITORING

Report 4

1991-1992 DATA COLLECTION REPORT



by

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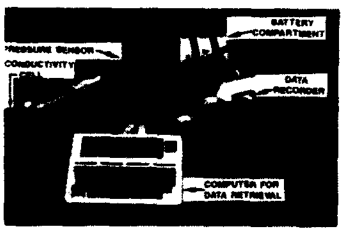

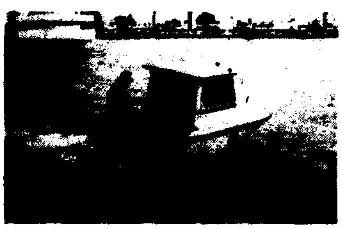

US ARMY ENGINEER WATERWAYS EXPERIMENT STATION

October 1992

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13. ABSTRACT *(Maximum 200 words)*

Water level, conductivity, temperature, and salinity were measured in the Cumberland Sound study area during January 1991 through March 1992. The data were collected as part of a long-term study to assess, through comparisons with earlier data collection programs, if changes to the estuarine processes of the study area have occurred. This report describes the equipment and procedures used in the data collection effort and presents tables and plots of representative data.

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PREFACE

The work described in this report was performed by the Hydraulics Laboratory (HL) of the US Army Engineer Waterways Experiment Station (WES) during January 1991 through March 1992 as a part of the overall Cumberland Sound Monitoring Program conducted for the Department of the Navy under the coordination of US Army Engineer Division, South Atlantic (SAD).

This study was conducted under the direction of Messrs. Frank A. Herrmann, Jr., Director, HL; Richard A. Sager, Assistant Director, HL; William H. McAnally, Jr., Chief, Estuaries Division, HL; George M. Fisackerly, Chief, Estuarine Processes Branch (EPB), Estuaries Division; and Ms. Joan Pope, Chief, Coastal Structures and Evaluation Branch, Coastal Engineering Research Center (CERC), WES. Technical direction and guidance during the study were provided by Messrs. Albert G. Green, Jr., National Park Service (NPS); Thomas J. Peeling, John Headland, and Darryl Molzan, Naval Facilities Engineering Command (NAVFACENGCOM), Charleston, SC; William Odum, University of Virginia, Charlotte, VA; and Robert G. Dean, University of Florida, Gainesville, FL, as members of the Kings Bay Coastal and Estuarine Monitoring Program Technical Review Committee.

This report was prepared by Messrs. Fisackerly, Timothy L. Fagerburg, Joseph W. Parman, and Mrs. Clara J. Coleman, all of EPB. The HL portion of the project study was managed by Mr. Fisackerly. The field data collection program was designed by Messrs. Fisackerly, A. M. Teeter, H. A. Benson, and M. A. Granat, EPB, and executed under the direction of Messrs. Fisackerly, Fagerburg, and Benson. Other WES personnel participating in the data collection effort were Messrs. S. E. Varnell, T. C. Pratt, and L. G. Caviness, EPB.

At the time of publication of this report, Director of WES was Dr. Robert W. Whalin. Commander was COL Leonard G. Hassell, EN.

CONTENTS

CONVERSION FACTORS, NON-SI TO SI (METRIC)
UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI (metric) units as follows:

Multiply	By	To Obtain
cubic feet	0.02831685	cubic metres
degrees Fahrenheit	5/9	Celsius degrees or kelvins*
feet	0.3048	metres
inches	2.540	centimetres
miles (US nautical)	1.852	kilometres
miles (US statute)	1.609344	kilometres
square feet	0.09290304	square metres
square miles	2.589988	square kilometres
yards	0.7645549	cubic metres

* To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use the following formula: $C = (5/9)(F - 32)$. To obtain Kelvin (K) readings, use: $K = (5/9)(F - 32) + 273.15$.

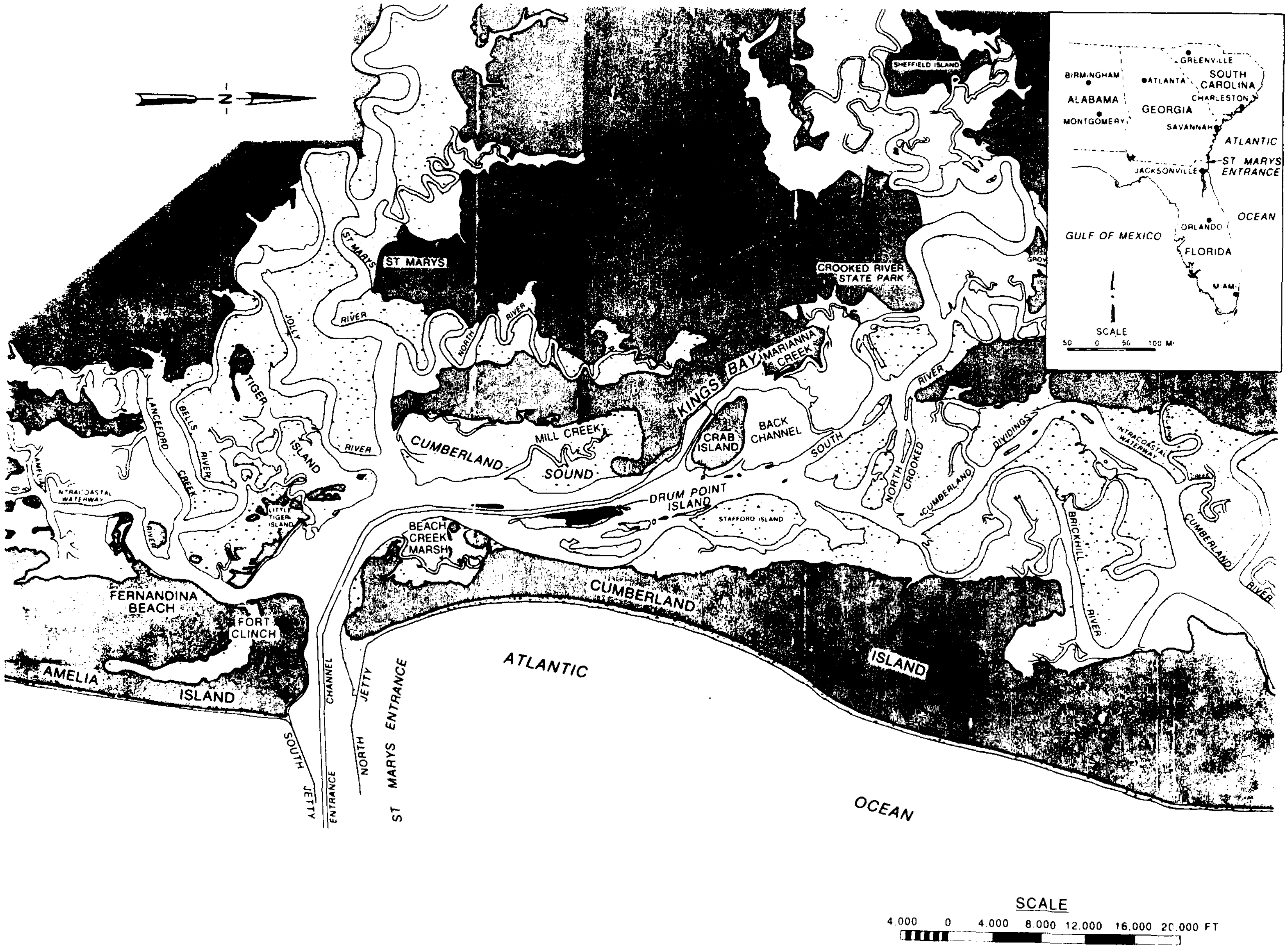

Figure 1. Cumberland Sound and Kings Bay vicinity map

CUMBERLAND SOUND MONITORING

1991-1992 DATA COLLECTION REPORT

PART I: INTRODUCTION

Background

1. The Cumberland Sound estuarine system is located in southeast Georgia. The system includes extensive salt marshes and sand flats (shaded areas on Figure 1) typical of the sea island system of southeast Georgia. A Naval Submarine Base, Kings Bay, is located within the sound and is located about 9.6 n.m.* north of the St. Marys Inlet entrance jetties at the Atlantic Ocean. The mean tidal range at the ocean entrance between Amelia Island, in the state of Florida, and Cumberland Island, in the state of Georgia, is 5.8 ft. Maximum spring tidal ranges can exceed 8.0 ft in the interior portions of the estuary.

2. The primary sources of fresh water for the Cumberland Sound estuarine system are the St. Marys and the Crooked Rivers. The long-term average freshwater discharge at the mouth of the rivers is about 1,500 cfs from the St. Marys River and 100 cfs from the Crooked River. Suspended sediment loads within the rivers are generally low.

3. Cumberland Sound is considered to be a well-mixed estuarine system due to the relatively low average total freshwater discharge and the relatively high tidal range and associated strong current velocities. Salinity within the sound and Kings Bay is generally vertically and laterally homogeneous. Longitudinally, salinity within the sound is only slightly reduced from the ocean entrance conditions. Salinity in Kings Bay typically varies from about 26 to 32 ppt during the year.

4. The original Kings Bay facility, located adjacent to Cumberland Sound in southeast Georgia, was designed and developed as an emergency Army Munitions Operation Transportation facility in the late 1950's. Initial

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* A table of factors for converting non-SI units of measure to SI (metric) units of measure is found on page 3.

channel depths were authorized at 32 ft mean low water.* The facility was never placed into operational use and was in a standby mobilization status with channel depths of about 32 ft. Figure 1 shows the general Cumberland Sound and Kings Bay area.

5. The Department of the Navy acquired the Kings Bay facility In July 1978, for use as a Naval submarine base for Poseidon class submarines. Between July 1978 and July 1979, major channel realignment, widening, and deepening were performed for Poseidon facility expansion on the lower entrance channels and the interior approach channels. The total length of the interior Poseidon channel, from the throat of St. Marys entrance adjacent to Fort Clinch to the end of the main docking facility, was about 7 nautical miles (n.m.).

6. In the 1980's, with the advent of the Trident submarines, changes to the channel were made to accommodate these large submarines. The Trident facilities expansion included widening and deepening the approach channel, deepening the ocean entrance, deepening and widening portions of Kings Bay as well as construction of various facilities in and around the submarine base. The specifics of these changes have been described in earlier reports.**,***

7. Recent changes raised concerns by the State of Florida and the Department of Interior (DOI), about the potential for adverse impacts to coastal processes on Amelia Island to the south and to the Cumberland Island National Seashore to the north of St. Mary's inlet.

8. As a result of these concerns, a 5-year study (1988-1992) was established to assess the effects of the Trident project on the estuarine and coastal processes in the area of Cumberland and Amelia Islands and Cumberland Sound. The US Army Engineer Waterways Experiment Station (WES) Hydraulics Laboratory is responsible for the program's estuarine studies. These studies

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* All depths and elevations (el) described in this report refer to local mean low water (mlw), which is 2.75 ft below National Geodetic Vertical Datum (NGVD).

** Granat, M. A., Brogdon, N. J., Cartwright, J. T., and McAnally Jr., W. H., 1989. "Verification of the Hydrodynamic and Sediment Transport Hybrid Modeling System for Cumberland Sound and Kings Bay Navigation Channel, Georgia," Technical Report No. HL-89-14, US Army Engineer Waterways Experiment Station, Vicksburg, MS, July 1989.

*** Fagerburg, T. L., Benson, H. A., Parman, J. W., and Fisackerly, G. M., 1991. "Cumberland Sound Monitoring, Report 1, 1988 Data Collection Report," Technical Report No. HL-91-4, US Army Engineer Waterways Experiment Station, Vicksburg, MS, February, 1991.

include some numerical model testing and long- and short-term field data collection to assess the potential effects on the hydrodynamics of the system. The areas of interest included tidal effects, changes in salinity, and sedimentation. The Coastal Engineering Research Center (CERC), WES, is responsible for the coastal portions of the programs and provides the central point of contact for the entire Kings Bay monitoring effort of WES.

9. The US Army Engineer Division, South Atlantic, serves as the lead office for coordination between the US Army Corps of Engineers and the Navy. In addition to WES, organizations involved in the overall monitoring program are the US Navy, South Atlantic Division, DOI, NPS, and the US Army Engineer Districts of Savannah and Jacksonville.

Purpose

10. The purpose of the overall Cumberland Sound monitoring program is to provide long-term monitoring of tides, conductivity, and temperature measurements at six stations throughout the system over a 5-year project duration. The purpose of this report is to present representative samples of the long-term data that were collected during the fourth and final year of the project.

Scope

11. This report presents representative results of the field data collection program in the Cumberland Sound system from January 1991 through March 1992. Measurements consisted of the following at each of six stations:

- a. Water surface elevations.
- b. Conductivity and temperature measurements for salinity calculations.
- c. Composite water samples for laboratory measurement of salinity and suspended sediment concentrations.

12. This report describes the field investigation methods used to collect the data, shows representative data and describes the availability of the data for further use.

PART II: EQUIPMENT DESCRIPTION, PROCEDURES, AND CONDITIONS

Equipment

13. Water level elevations, and temperature, conductivity, and salinity measurements, were recorded using Environmental Devices Corporation (ENDECO) model 1152 SSM (solid state measurement) water level recorders similar to that shown in Figure 2. Water samples for suspended sediment concentrations were obtained using American Sigma Streamline Model 720 automatic water samplers similar to that shown in Figure 3.

Water level recorder

14. The ENDECO model 1152 SSM recorder contains a strain gage type pressure transducer located in a subsurface case which is used to record the absolute pressure of the column of water above the case. The pressure transducer is vented to the atmosphere by a small tube in the signal cable to compensate for changes in atmospheric pressure. The pressure was measured for 49 seconds of each minute of the recording interval with a frequency of 5-55 KHz to filter out surface waves, therefore eliminating the need for a stilling well. The accuracy is ±0.02 ft. The sampling time interval can be set from 1 minute to 1 hour on the 1152SSM. A 10 min sampling interval was chosen for this study.

Temperature, conductivity, and salinity measurements

15. Temperature was measured by means of a thermistor built into the water level recorder. The thermistor has a range of -5 C to +45 C, with an accuracy of ±0.08 C. Conductivity was measured by means of an inductively coupled probe. The probe has a range of 0-80 mmho/cm with an accuracy of ±0.55 mmho/cm. Salinity values were then computed from the output of the conductivity and temperature measurements and displayed in units of parts per thousand (ppt).

16. The sampling time interval for these parameters was set the same (10 min) as for the water level measurements (the time intervals cannot be set independently.) The data from each recorder were stored on a removable EPROM solid state memory cartridge located in a waterproof surface unit which also contained the d-c power supply.

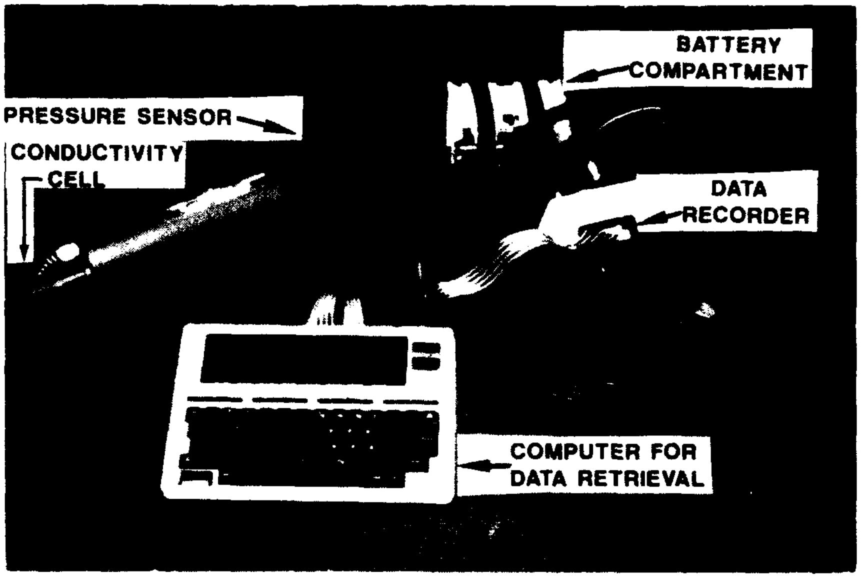


Figure 2. Water level recorder

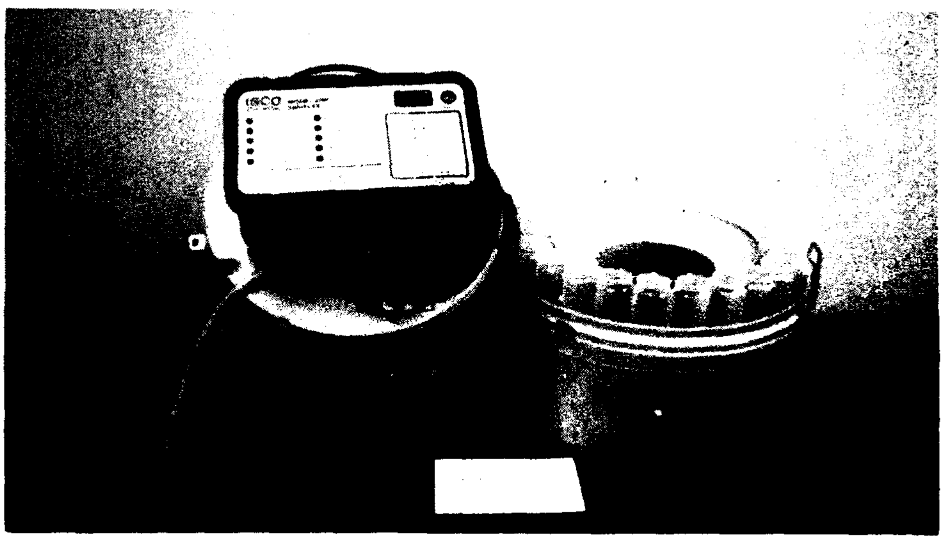


Figure 3. Automatic water sampler

Automatic water samplers

17. Composite water samples (multiple samples per sample bottle) were obtained at each water level recorder location using American Sigma Streamline water samplers model 702, as shown in Figure 3. A typical field installation of these water samplers is shown in Figure 4. The samplers operate from a 12-Volt d-c battery. Samples are collected in 1-liter plastic bottles inside the sampler housing. The samplers are fully programmable for obtaining any volume of sample desired up to the maximum size of the bottle, for obtaining composite samples, and for setting times to begin the sampling routine. Upon completion of the sampling program, the bottles are removed and replaced with empty ones to begin the new sampling period.

18. Six samplers, one at each water level recorder location, were installed in July 1989. The intake lines to the samplers were set to obtain samples at approximately the mid-depth of each location. The samplers were programmed to collect four samples per bottle with the time interval between samples set for 373 minutes.

Measurement locations

19. Six water level recorders and water samplers were deployed

Figure 4. Field installation of water sampler

throughout the Cumberland Sound system as shown in Figure 5. The locations adequately covered the total study area to provide information on (a) differences in time of peak tides and range of tides and (b) salinities and sediment concentrations.

Field Service Procedures

20. Periodic equipment service trips (usually monthly) were made by WES personnel. Servicing included first making a visual inspection of the equipment. The sample bottles from each sampler were removed and replaced with empty ones. Intake lines were inspected and cleaned of any aquatic growth or obstruction. Batteries were replaced and the samplers were reprogrammed to begin the new sampling period.

21. A portable computer was connected to the 1152SSM water level recorder to obtain a current display of the data that the sensor was obtaining. These data were compared to in-field checks of salinity and water level. In-field checks of salinity were made using a portable Aanderaa salinity meter, shown in Figure 6. A water sample was also collected at the same depth of the sensor and returned to the laboratory along with the other water samples for analysis of salinity and sediment concentrations.

22. The approximate water depth over the sensor was recorded by measuring the distance from the water surface to a known reference point on the sensor support bracket. The data recording cartridge was then removed and replaced with a new cartridge. New batteries were installed and the desiccant, used to absorb moisture in the surface housing, was replaced.

23. The subsurface sensor was brought to the surface, inspected and any barnacles or other aquatic growth removed. After cleaning the sensor, it was returned to its original position and the computer connected to the 1152SSM. The instrument's readings were then compared to a new set of in-field measurements. This procedure was performed on all the recording units to verify their proper operation.

Meteorological Conditions

24. The Cumberland Sound/Kings Bay area has an annual mean temperature of 70 degrees F with extremes ranging from the teens to 100 degrees F. The

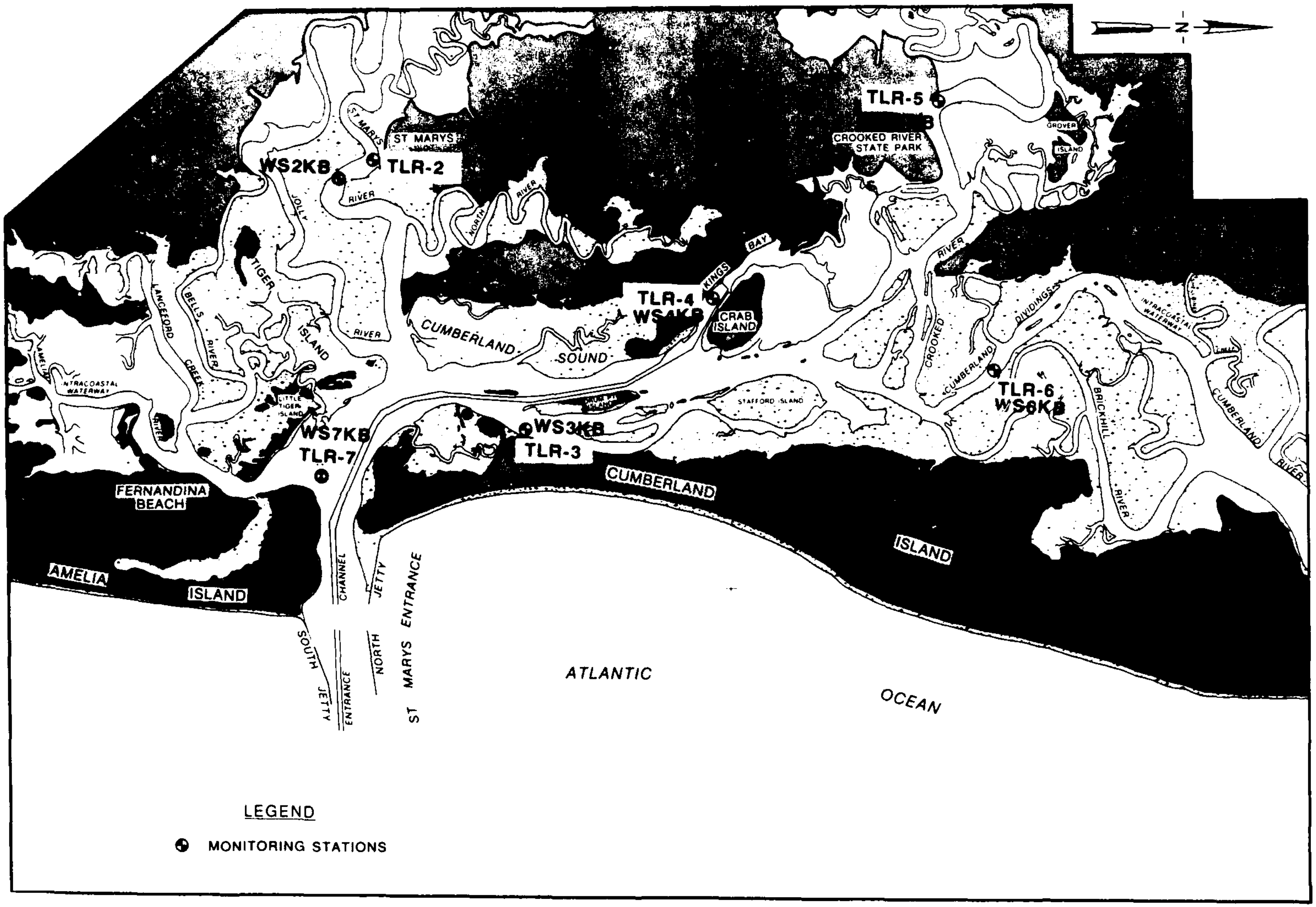


Figure 5. Location of Cumberland Sound monitoring stations

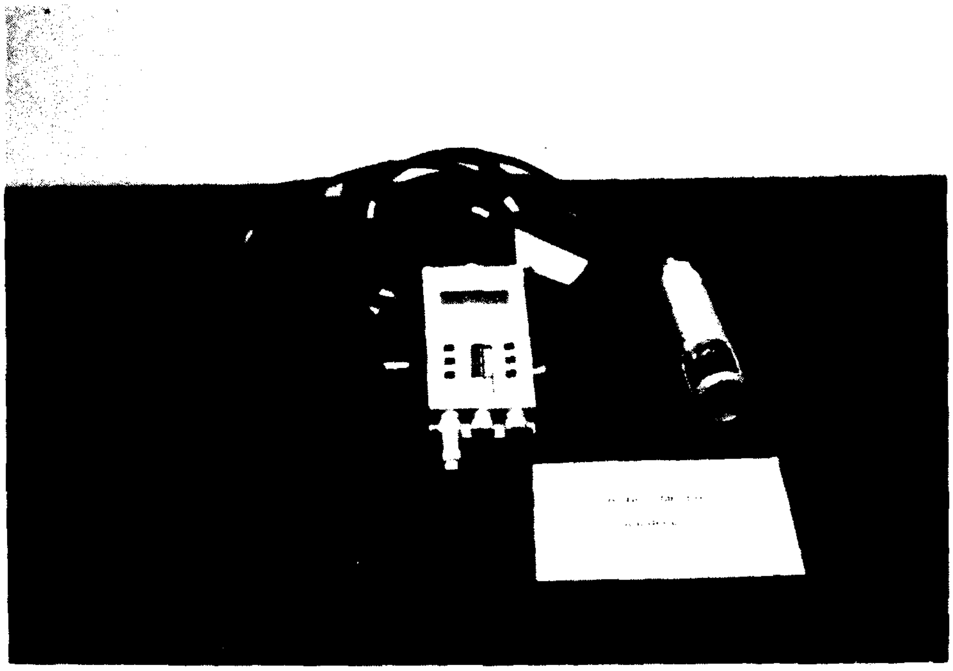


Figure 6. Portable salinity meter

yearly average rainfall is 50-55 inches. Freshwater inflows from the St. Marys river are given by stages recorded from a USGS gaging station located near Macclenny, FL. These data, gage height and discharges for the water year October 1990 - September 1991, are presented in Tables 1 - 2.

Laboratory Analysis of the Water Samples

25. The samples collected by the water samplers were analyzed in the laboratory at the US Army Engineer Waterways Experiment Station. Total suspended materials were determined by filtration of the samples. Nuclepore polycarbonate filters with 0.4 micron pore size were used in this procedure. The samples were desiccated and preweighed, and a vacuum system was used to draw the sample through the filter. The filters and holders were washed with distilled water, dried at 105 deg C for 1 hr and reweighed. The total suspended materials were calculated based on the weight and volume of the filtered sample.

26. The laboratory analyses of the salinities for the water samples were performed using an AGE Instruments Incorporated Model 2100 MINISAL salinometer. This microprocessor-controlled instrument calculates and displays salinity with calibrations for temperature, cell constant, and salinity of standard sea water. Standard Sea Water is used as the standard during all analyses. The accuracy of the measurements is ± 0.003 ppt on samples ranging

from 2 to 42 ppt. The samples were analyzed and recorded to the nearest 0.01 ppt.

PART III: THE DATA

27. The data described herein are available in tabular, graphical, and magnetic media format. Due to the enormous amounts of data only representative samples are presented in this report. For more detailed information, the tabulated computer printouts and plots are available upon request. Written requests for the data can be made to the following address:

USACE Waterways Experiment Station
ATTN: CEWES-HE-P
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

28. The information presented in Tables 3 and 4 are examples of the tabulated format for the water levels (depth of sensor below water surface), salinities, and temperatures which are available for each data recording location. Time is given in hours and minutes, Eastern Standard Time (EST), for each reading of depth, conductivity, temperature, and salinity.

29. Tables 5 - 7 are examples of the tabulated format for the suspended sediment concentrations which are also available for each data recording location.

30. As with any long term measurement effort, there are periods when the equipment malfunctions for various reasons. The information presented in Tables 8-9 list the status of each water level-salinity-temperature recorder and water sampler during the 15 month data collection period (1-1-91 through 3-31-92).

31. Typical examples of the graphical format for the water levels, salinities, temperatures, and suspended sediment concentrations are presented in Plates 1-47. These plots are presented to illustrate the changes that typically occur during various seasons of the year. Plates 1-6 display the water levels, salinities, and temperatures during the spring period (March - April). Plates 7 -12 display the data collected during the summer period (July). Plates 13 - 21 display the data collected during the autumn period (October). Plates 22-30 display the data collected during the winter period (November - December). Plates 31-39 display the changes that occur during the winter/-spring period (January - March 1992). Suspended sediment concentrations for

the corresponding spring, summer, and autumn periods are displayed in Plates 40-47.

32. The locations used for the representative samples were chosen to show the changing conditions with the seasons in the St. Marys entrance area (TLR-7 and WS7KB; high salinity), in the Navy Submarine base (TLR-4 and WS4KB; limited freshwater inflow), and in the Crooked River area (TLR-5 and WS5KB; small watershed freshwater inflow).

33. Datum planes for the tide data at each location are correctable for mean-low-water (mlw), from tidal bench marks that were established in August 1989. The datum for each water level elevation plot represents the monthly mean water level reading for each location. The mlw correction for each plot is noted on the plates.

PART IV: SUMMARY

34. The information presented herein represents a portion of the data collected during the fourth and final year of the study. This report is the fourth in a series of four annual interim data reports. All information from each period of the study will be used to determine if changes to the estuarine processes have occurred due to physical changes of the navigation channel. This determination will be made through comparisons of the data from this five year study to data collected prior to the changed channel conditions.

Table 1

Mean Values of Gage Height for St. Marys River Near Macclenny, FL

October 1990 - September 1991

GAGE HEIGHT, FEET, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.75	.85	.79	.81	11.54	3.58	6.79	11.07	6.26	10.89	---	6.37
2	---	.35	.78	.81	11.38	3.93	6.38	10.78	7.46	10.26	11.30	6.05
3	---	.33	.78	.81	10.96	9.48	5.93	10.38	6.96	9.22	11.92	5.73
4	---	.83	.79	.81	10.43	12.82	5.53	9.76	6.24	---	11.97	6.14
5	---	.81	.78	.82	9.82	14.13	5.25	8.99	8.84	---	12.15	6.75
6	.71	.80	.73	.84	9.20	14.19	5.39	8.16	12.31	---	12.61	7.06
7	.69	.79	.80	.92	8.70	13.72	5.64	7.41	13.67	---	12.94	6.70
8	.69	.79	.88	1.09	8.46	13.11	5.51	6.94	13.74	---	12.92	6.19
9	.68	.80	.93	1.00	8.24	12.48	7.11	6.44	13.38	---	12.53	5.76
10	.55	.80	.93	.95	7.76	11.93	9.55	5.93	12.90	6.52	11.92	5.37
11	1.43	.81	.93	1.06	7.17	11.49	10.32	5.54	12.22	8.45	11.27	5.04
12	2.05	.84	.89	1.84	6.62	10.97	10.19	5.61	11.48	10.46	10.72	4.74
13	2.17	.84	.86	2.58	6.13	10.35	9.55	5.62	10.67	11.57	10.29	4.50
14	1.75	.83	.85	1.97	5.95	9.44	8.75	5.44	9.76	11.83	9.69	4.27
15	1.43	.81	.85	1.64	6.63	9.40	7.96	5.94	9.01	11.24	9.07	4.07
16	1.33	.81	.84	1.53	6.65	8.99	7.34	6.45	8.77	10.53	8.42	3.83
17	1.22	.80	.83	1.46	6.17	8.59	6.84	6.76	8.26	9.86	7.94	3.71
18	1.14	.79	.83	1.40	5.75	9.63	8.29	7.44	7.32	9.85	7.44	3.58
19	1.08	.78	.83	1.43	5.42	11.55	10.42	7.66	7.25	10.51	6.69	3.44
20	1.05	.73	.83	---	5.13	12.37	10.94	7.45	7.77	10.56	6.16	3.34
21	1.02	.78	.83	---	4.86	12.20	11.16	7.19	7.69	---	5.80	3.26
22	1.01	.79	.83	---	4.62	11.77	11.49	6.80	6.96	---	5.37	3.21
23	1.01	.78	.82	---	4.46	11.29	11.66	6.10	6.39	---	5.04	3.18
24	1.00	.78	.81	---	4.50	10.72	12.64	5.47	5.89	---	5.66	3.11
25	.96	.73	.80	---	4.33	10.07	13.50	5.36	6.36	---	7.47	3.01
26	.95	.78	.80	---	4.14	9.39	13.43	5.38	7.81	---	7.41	---
27	.93	.79	.80	---	3.95	8.70	13.15	5.49	8.74	---	7.69	3.42
28	.91	.80	.80	---	3.76	7.97	12.72	6.86	9.83	---	8.18	3.34
29	.89	.79	.81	---	---	7.29	12.20	7.26	10.51	---	7.51	3.20
30	.89	.79	.81	10.44	---	6.90	11.64	6.71	10.83	---	6.82	3.78
31	.87	---	.81	---	---	6.95	---	6.13	---	---	6.45	---
MEAN	---	.80	.83	---	6.85	10.17	9.24	7.05	9.18	---	---	---
MAX	---	.85	.93	---	11.54	14.19	13.50	11.07	13.67	---	---	---
MIN	---	.78	.78	---	3.76	3.58	5.25	5.36	5.89	---	---	---

Note: From provisional tables in the USGS Annual Gage Height and Discharge Report for Water Year 1990.

Table 2

Mean Values of Discharge for St. Marys River Near Macclenny, FL

October 1990 - September 1991

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	20	25	22	23	2290	325	574	2090	775	2000	1700	793
2	20	25	22	23	2220	350	796	1960	1010	1750	2190	735
3	e20	24	21	23	2040	1600	713	1790	910	1440	2520	677
4	e19	24	22	23	1910	3290	641	1390	769	1190	2560	751
5	19	23	21	23	1500	4650	592	1380	1300	e800	2700	867
6	18	23	21	25	1440	4730	616	1160	2830	e750	3030	928
7	17	22	22	29	1310	4140	661	1000	4320	e1100	3370	856
8	17	22	27	39	1250	3530	e637	903	4160	e1020	3350	761
9	17	23	30	33	1200	2970	951	908	3780	890	3010	683
10	25	23	32	30	1090	2530	1530	713	3330	822	2530	613
11	62	23	29	37	952	2270	1770	542	2760	1260	2170	554
12	114	24	27	98	942	2040	1720	656	2270	1830	1930	505
13	125	24	26	167	751	1780	1530	656	1910	2310	1760	466
14	86	24	25	107	717	1600	1320	625	1590	2450	1570	430
15	65	23	25	75	843	1490	1130	715	1390	2160	1400	399
16	55	23	24	70	848	1380	988	803	1330	1850	1240	369
17	47	22	24	64	752	1230	885	968	1200	1620	1120	343
18	42	22	24	60	681	1570	1210	1010	996	1610	1010	325
19	37	22	24	62	621	2320	1920	1060	967	1840	653	304
20	36	21	24	422	571	2870	2040	1010	1090	1560	756	290
21	34	22	24	e433	526	2740	2120	955	1070	1710	690	280
22	34	22	24	e470	485	2420	2270	976	909	e1900	613	273
23	34	22	23	e450	460	2150	2350	744	798	e1800	555	268
24	33	21	23	e600	466	1930	3120	630	706	e1700	665	259
25	32	21	22	e500	441	1630	3910	611	796	e1625	1020	247
26	31	21	22	e600	411	1490	3830	613	1090	e1700	1000	260
27	29	22	23	e750	330	1310	3560	634	1320	e1700	1070	301
28	28	22	22	812	350	1130	3170	891	1610	e1650	1130	290
29	27	22	23	1250	---	978	2740	970	1850	e1625	1030	271
30	27	22	23	1830	---	895	2350	960	1980	e1750	851	356
31	26	---	23	2200	---	905	---	749	---	e1550	810	---
TOTAL	1199	679	744	11916	27343	64413	51844	29987	50946	49572	50333	14454
MEAN	38.7	22.6	24.0	384	977	2078	1728	967	1698	1599	1624	482
MAX	125	25	32	2200	2290	4730	3910	2090	4320	2460	3370	928
MIN	17	21	21	23	350	325	592	611	706	750	555	247
CFSM	.06	.03	.03	.55	1.40	2.97	2.47	1.39	2.43	2.28	2.32	.69
IN.	.06	.04	.04	.63	1.45	3.42	2.76	1.59	2.71	2.63	2.67	.77

CAL YR 1990 TOTAL 60045 MEAN 165 MAX 1870 MIN 16 CFSM .24 IN. 3.19
WTR YR 1991 TOTAL 353430 MEAN 963 MAX 4730 MIN 17 CFSM 1.39 IN. 18.78

e Estimated

Note: From provisional tables in the USGS Annual Gage Height and Discharge Report for Water Year 1990.

Table 3

Sample Printout of Water Level Recorder Data for Station TLR-3

KINGS BAY - STA T3 CUMBERLAND ISLAND - 20 MAR-24 APR 1991

ENDECO TYPE 1152 DENSITY COMPENSATING WATER LEVEL RECORDER
DATUM OFFSET APPLIED: -2.120 (FEET)
SERIAL NUMBER: 11520273

DATE (MM/DD/YY)	TIME (HH:MM)	TEMPERATURE (CELSIUS)	CONDUCTIVITY (MMHO/CM)	SALINITY (PPT)	DEPTH (FEET)
03/20/91	11:00	18.17	32.66	23.9	6.398
03/20/91	11:10	18.13	32.88	24.1	6.406
03/20/91	11:20	18.12	32.89	24.1	6.432
03/20/91	11:30	18.11	32.93	24.1	6.426
03/20/91	11:40	18.12	32.60	23.9	6.423
03/20/91	11:50	18.24	30.23	21.9	6.380
03/20/91	12:00	18.24	30.71	22.3	6.344
03/20/91	12:10	18.26	30.32	21.9	6.230
03/20/91	12:20	18.24	31.06	22.6	6.117
03/20/91	12:30	18.70	29.15	20.8	5.934
03/20/91	12:40	18.97	28.85	20.4	5.815
03/20/91	12:50	19.70	28.20	19.6	5.649
03/20/91	13:00	19.78	28.37	19.7	5.455
03/20/91	13:10	19.98	27.52	18.9	5.236
03/20/91	13:20	19.83	27.96	19.3	5.015
03/20/91	13:30	19.90	27.51	19.0	4.751
03/20/91	13:40	20.02	27.59	19.0	4.488
03/20/91	13:50	20.25	27.22	18.6	4.214
03/20/91	14:00	19.95	27.58	19.0	3.948
03/20/91	14:10	20.16	27.31	18.7	3.644
03/20/91	14:20	19.99	27.49	18.9	3.355
03/20/91	14:30	19.83	27.38	18.9	3.062
03/20/91	14:40	19.73	27.30	18.9	2.780
03/20/91	14:50	19.59	27.26	18.9	2.470
03/20/91	15:00	19.56	27.33	19.0	2.191
03/20/91	15:10	19.50	27.31	19.0	1.899
03/20/91	15:20	19.67	27.48	19.0	1.604
03/20/91	15:30	19.77	27.47	19.0	1.368
03/20/91	15:40	19.95	27.54	19.0	1.118
03/20/91	15:50	20.03	27.49	18.9	.903
03/20/91	16:00	20.09	27.18	18.6	.699

Table 4

Sample Printout of Water Level Recorder Data for Station TLR-5

KINGS BAY - STA T5 CROOKED RIVER STATE PARK - 19 MAR-23 APR 1991

ENDECO TYPE 1152 DENSITY COMPENSATING WATER LEVEL RECORDER
DATUM OFFSET APPLIED: -4.400 (FEET)
SERIAL NUMBER: 11520277

DATE (MM/DD/YY)	TIME (HH:MM)	TEMPERATURE (CELSIUS)	CONDUCTIVITY (MMHO/CM)	SALINITY (PPT)	DEPTH (FEET)
03/20/91	11:00	16.72	21.41	15.6	2.990
03/20/91	11:10	16.73	21.47	15.6	3.131
03/20/91	11:20	16.74	21.49	15.6	3.235
03/20/91	11:30	16.75	21.54	15.7	3.313
03/20/91	11:40	16.73	21.61	15.7	3.382
03/20/91	11:50	16.70	21.62	15.7	3.448
03/20/91	12:00	16.68	21.63	15.8	3.506
03/20/91	12:10	16.69	21.71	15.8	3.534
03/20/91	12:20	16.70	21.53	15.7	3.532
03/20/91	12:30	16.72	21.54	15.7	3.517
03/20/91	12:40	16.74	21.43	15.6	3.480
03/20/91	12:50	16.75	21.45	15.6	3.416
03/20/91	13:00	16.76	21.38	15.5	3.333
03/20/91	13:10	16.78	21.37	15.5	3.181
03/20/91	13:20	16.78	21.36	15.5	3.021
03/20/91	13:30	16.79	21.44	15.6	2.844
03/20/91	13:40	16.81	21.42	15.5	2.661
03/20/91	13:50	16.83	21.47	15.6	2.468
03/20/91	14:00	16.87	21.49	15.6	2.260
03/20/91	14:10	16.91	21.62	15.7	2.039
03/20/91	14:20	16.96	21.83	15.8	1.788
03/20/91	14:30	17.08	21.89	15.8	1.543
03/20/91	14:40	17.21	21.92	15.8	1.313
03/20/91	14:50	17.33	22.00	15.8	1.045
03/20/91	15:00	17.45	22.04	15.8	.793
03/20/91	15:10	17.61	22.10	15.8	.535
03/20/91	15:20	17.77	22.12	15.7	.287
03/20/91	15:30	17.93	22.12	15.7	.021
03/20/91	15:40	18.04	22.02	15.5	-.227
03/20/91	15:50	18.08	21.95	15.5	-.486
03/20/91	16:00	18.11	21.90	15.4	-.744

Table 5

Daily Average of Suspended Sediment Concentrations, MG/L

for the Automatic Water Samplers

March/April 1991

Date Mar/Apr 91	Sampler No. ws2KB	ws3KB	ws4KB	ws5KB	ws6KB	ws7KB
22	55	*	27	61	46	21
23	47	*	9	38	24	2
24	38	*	5	32	35	3
25	42	*	12	32	41	12
26	46	*	11	38	35	5
27	40	*	11	45	45	4
28	39	*	15	42	49	3
29	41	*	5	58	54	57
30	40	*	11	44	81	2
31	47	*	14	40	67	3
1	35	*	15	38	60	3
2	*	*	18	30	57	2
3	*	*	16	35	71	5
4	*	*	23	28	50	5
5	*	*	14	28	64	6
6	*	*	11	24	58	4
7	*	*	15	19	47	4
8	*	*	18	28	49	7
9	*	*	23	31	57	5
10	*	*	25	37	117	3
11	*	*	21	40	130	2
12	*	*	18	35	100	3
13	*	*	19	51	102	2
14	*	*	22	43	105	4

* No data available.

Table 6

Daily Average of Suspended Sediment Concentrations, MG/L

for the Automatic Water Samplers

September 1991

Date	Sampler No.					
Sep 91	ws2KB	ws3KB	ws4KB	ws5KB	ws6KB	ws7KB
6	43	72	25	38	*	30
7	59	47	17	35	*	17
8	49	46	14	33	*	31
9	60	72	11	31	*	27
10	67	52	18	34	*	21
11	39	67	14	30	*	9
12	20	68	14	39	*	19
13	24	86	13	31	*	11
14	34	70	26	23	*	20
15	23	56	16	34	*	12
16	29	43	26	38	*	12
17	30	38	19	34	*	16
18	24	55	19	36	*	13
19	24	36	17	34	*	16
20	19	71	23	33	*	30
21	37	50	21	32	*	64
22	25	72	31	32	*	33
23	30	35	87	39	*	33
24	129	66	27	46	*	22
25	76	47	15	63	*	*
26	118	37	17	44	*	*
27	51	*	11	45	*	*
28	*	*	18	27	*	*
29	*	*	28	*	*	*

* No data available.

Table 7

Daily Average of Suspended Sediment Concentrations, MG/L

for the Automatic Water Samplers

January/February 1992

Date Feb 92	Sampler No. ws2KB	ws3KB	ws4KB	ws5KB	ws6KB	ws7KB
17	*	*	7	38	98	*
18	*	*	8	30	69	*
19	*	*	17	29	100	*
20	*	*	14	18	153	*
21	*	*	16	24	96	*
22	*	*	5	36	48	*
23	*	*	3	38	83	*
24	*	*	4	56	86	*
25	*	*	*	41	77	*
26	*	*	4	28	61	*
27	*	*	2	21	61	*
28	*	83	4	21	65	*
29	*	133	5	21	57	*
30	*	*	3	20	43	*
31	*	*	4	28	47	*
1	*	*	*	24	38	*
2	*	*	*	26	30	*
3	*	*	*	26	36	*
4	*	*	*	27	48	*
5	*	*	*	50	47	*
6	*	*	*	64	44	*
7	*	*	*	*	*	*
8	*	*	*	*	*	*
9	*	*	*	*	92	*

* No data available.

Table 8

Status of Water Level, Salinity and Temperature Recording Gages

Station No.	Data Periods Beginning Date	Ending Date	Comments
TLR-7	1/09/91	2/12/91	
	2/12/91	3/19/91	
	3/19/91	4/24/91	
	4/24/91	6/19/91	Meter out for maintenance
	6/19/91	8/04/91	Meter out for maintenance
	8/04/91	9/05/91	Meter out; replaced 9/5/91
	9/05/91	11/20/91	
	11/20/91	1/15/92	
	1/15/92	2/12/92	
	2/12/92	3/17/92	End data collection; meter removed
TLR-2	1/09/91	2/12/91	Meter removed 2/12/91; no spare
	2/12/91	3/20/91	Meter installed 3/20/91
	3/20/91	4/23/91	
	4/23/91	6/19/91	Meter bad; replaced
	6/19/91	8/04/91	
	8/04/91	9/05/91	Meter bad; replaced
	9/05/91	11/20/91	
	11/20/91	1/15/92	
	1/15/92	2/12/92	
	2/12/92	3/17/92	End data collection; meter removed
TLR-3	1/09/91	2/12/91	Meter out for service
	2/12/91	3/20/91	Meter installed 3/20/91
	3/19/91	4/24/91	
	4/24/91	6/19/91	Meter bad; replaced
	6/19/91	8/04/91	
	8/04/91	9/05/91	Meter bad; replaced
	9/05/91	11/20/91	
	11/20/91	1/15/92	
	1/15/92	2/12/92	
	2/12/92	3/17/92	End data collection; meter removed
TLR-4	1/09/91	2/12/91	
	2/12/91	3/19/91	
	3/19/91	4/24/91	Meter bad; removed 3/19/91
	4/24/91	6/19/91	Meter reinstalled 4/24/91
	6/19/91	8/04/91	
	8/04/91	9/05/91	Meter bad; replaced
	9/05/91	11/20/91	
	11/20/91	1/15/92	
	1/15/92	2/12/92	
	2/12/92	3/17/92	End data collection; meter removed

(Continued)

Table 8 (Concluded)

Station No.	Data Periods Beginning Date	Ending Date	Comments
TLR-5	1/09/91	2/12/91	
	2/12/91	3/19/91	
	3/19/91	4/24/91	
	4/24/91	6/19/91	Meter bad; replaced
	6/19/91	8/04/91	
	8/04/91	9/05/91	Meter bad; replaced
	9/05/91	11/20/91	
	11/20/91	1/15/92	
	1/15/92	2/12/92	
	2/12/92	3/17/92	End data collection; meter removed
TLR-6	1/09/91	2/12/91	
	2/12/91	3/19/91	
	3/19/91	4/24/91	
	4/24/91	6/19/91	Meter bad; replaced
	6/19/91	8/04/91	
	8/04/91	9/05/91	Meter bad; replaced
	9/05/91	11/20/91	
	11/20/91	1/15/92	
	1/15/92	2/12/92	
	2/12/92	3/17/92	End data collection; meter removed

Table 9

Status of Automatic Water Samplers

Sampler No.	Sample Periods Start Date	End Date	Comments
WS7KB	1/09/91	2/12/91	Partial samples*
	2/12/91	3/19/91	Partial samples**
	3/22/91	4/24/91	
	4/26/91	6/19/91	
	6/21/91	8/04/91	
	8/06/91	9/05/91	
	9/06/91	11/20/91	
	11/22/91	1/15/92	
	1/17/92	2/12/92	No samples*
	2/14/92	3/17/92	End data collection; sampler removed
WS2KB	1/09/91	2/12/91	No samples**
	2/12/91	3/20/91	Partial samples*
	3/22/91	4/24/91	Partial samples*
	4/26/91	5/22/91	
	5/24/91	6/19/91	
	6/21/91	8/04/91	
	8/06/91	9/04/91	
	9/06/91	11/20/91	
	11/22/91	1/15/92	Partial samples*
	1/17/92	2/12/92	Partial samples*
	2/14/92	3/17/92	End data collection; meter removed
WS3KB	1/09/91	2/12/91	Partial samples*
	2/14/91	3/20/91	Partial samples*
	3/22/91	4/24/91	No samples*
	4/26/91	6/19/91	
	6/21/91	8/04/91	Partial samples**
	8/06/91	9/04/91	Partial samples*
	9/06/91	11/20/91	No samples*
	11/22/91	1/15/92	Partial samples*
	1/17/92	2/12/92	Partial samples*
	2/14/92	3/17/92	End data collection; meter removed
WS4KB	1/09/91	2/12/91	Partial samples**
	2/14/91	3/19/91	Partial samples*
	3/22/91	4/24/91	
	4/26/91	6/19/91	
	6/21/91	8/04/91	
	8/06/91	9/04/91	
	9/06/91	11/20/91	
	11/22/91	1/15/92	Partial samples*

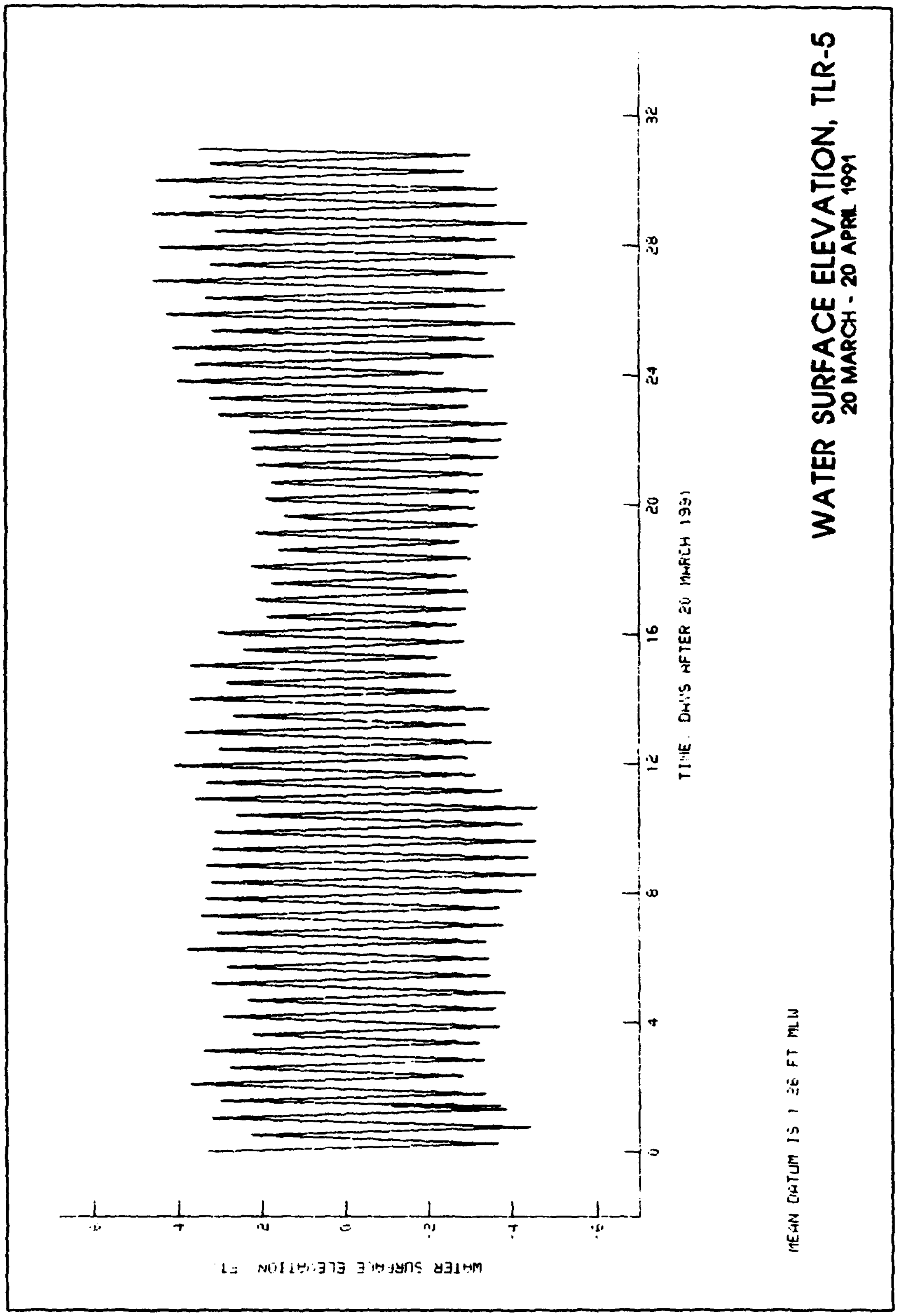
(Continued)

* - Malfunction due to low battery voltage.
** - Malfunction due to equipment failure.

Table 9 (Concluded)

Sampler No.	Sample Periods: Start Date	Sample Periods: End Date	Comments
WS4KB (Cont.)	1/17/92	2/12/92	Partial samples**
	2/14/92	3/17/92	End data collection; meter removed
WS5KB	1/09/91	2/12/91	
	2/14/91	3/19/91	
	3/22/91	4/23/91	
	4/26/91	5/21/91	
	5/24/91	6/18/91	Partial samples*
	6/21/91	8/05/91	
	8/06/91	9/05/91	Partial samples**
	9/06/91	11/20/91	
	11/22/91	1/15/92	No samples*
	1/17/92	2/12/92	Partial samples*
	2/14/92	3/17/92	End data collection; meter removed
WS6KB	1/09/91	2/12/91	Partial samples**
	2/14/91	3/19/91	No samples**; replaced
	3/19/91	4/24/91	
	4/26/91	6/19/91	Partial samples*
	6/21/91	8/04/91	Partial samples**
	8/06/91	9/05/91	No samples**
	9/06/91	11/20/91	No samples**
	11/22/91	1/14/92	Partial samples*
	1/17/92	2/12/92	
	2/14/92	3/17/92	End data collection; meter removed

* - Malfunction due to low battery voltage.
** - Malfunction due to equipment failure.



WATER SURFACE ELEVATION, TLR-5
20 MARCH - 20 APRIL 1991
WATER SURFACE ELEVATION, FT
TIME, DAYS AFTER 20 MARCH 1991
MEAN DATUM IS 1.26 FT MLW
0
4
8
12
16
20
24
28
32

PLATE 1

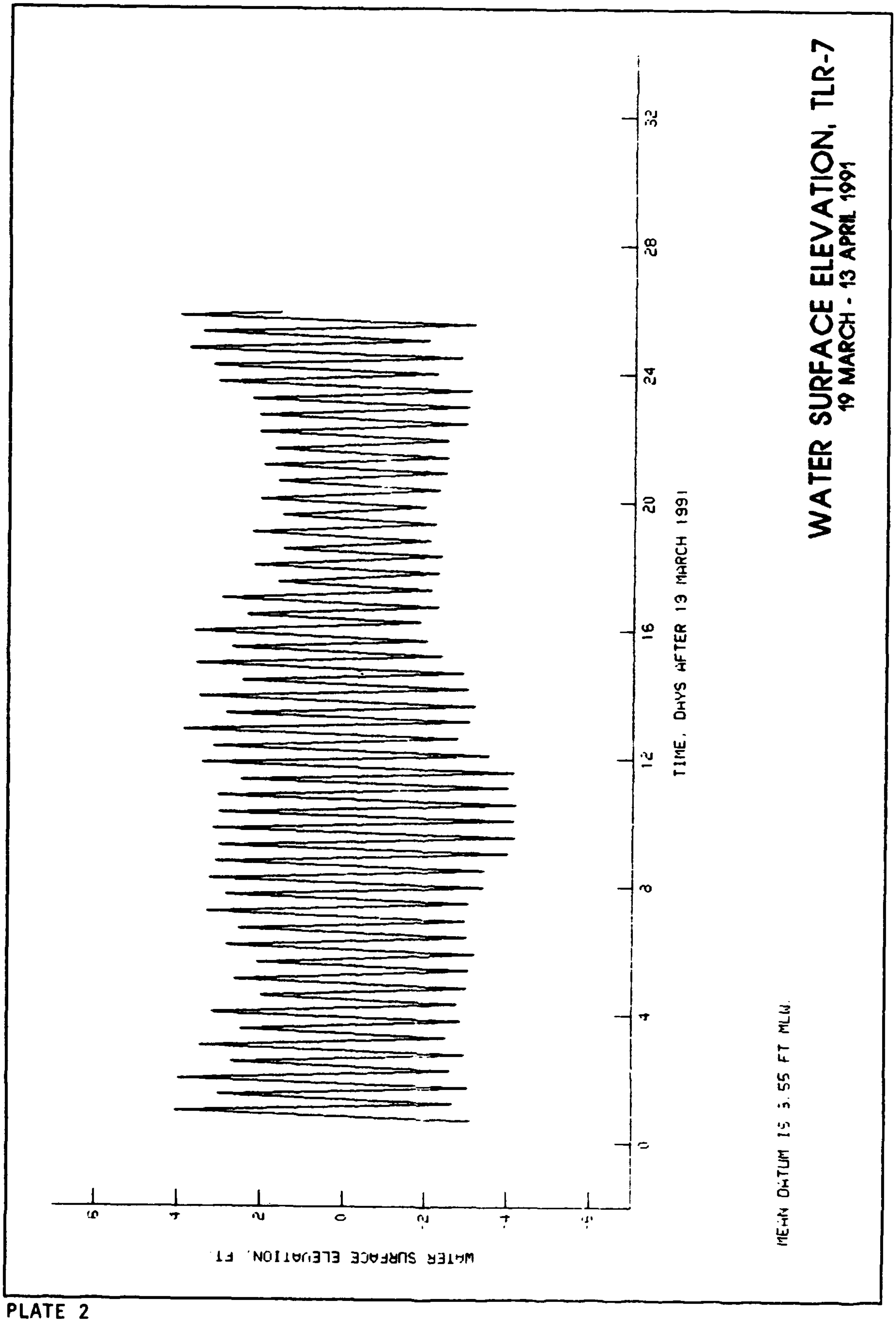

WATER SURFACE ELEVATION, TLR-7
19 MARCH - 13 APRIL 1991
TIME, DAYS AFTER 19 MARCH 1991
WATER SURFACE ELEVATION, FT
MEAN DATUM IS 3.55 FT MLW.

PLATE 2

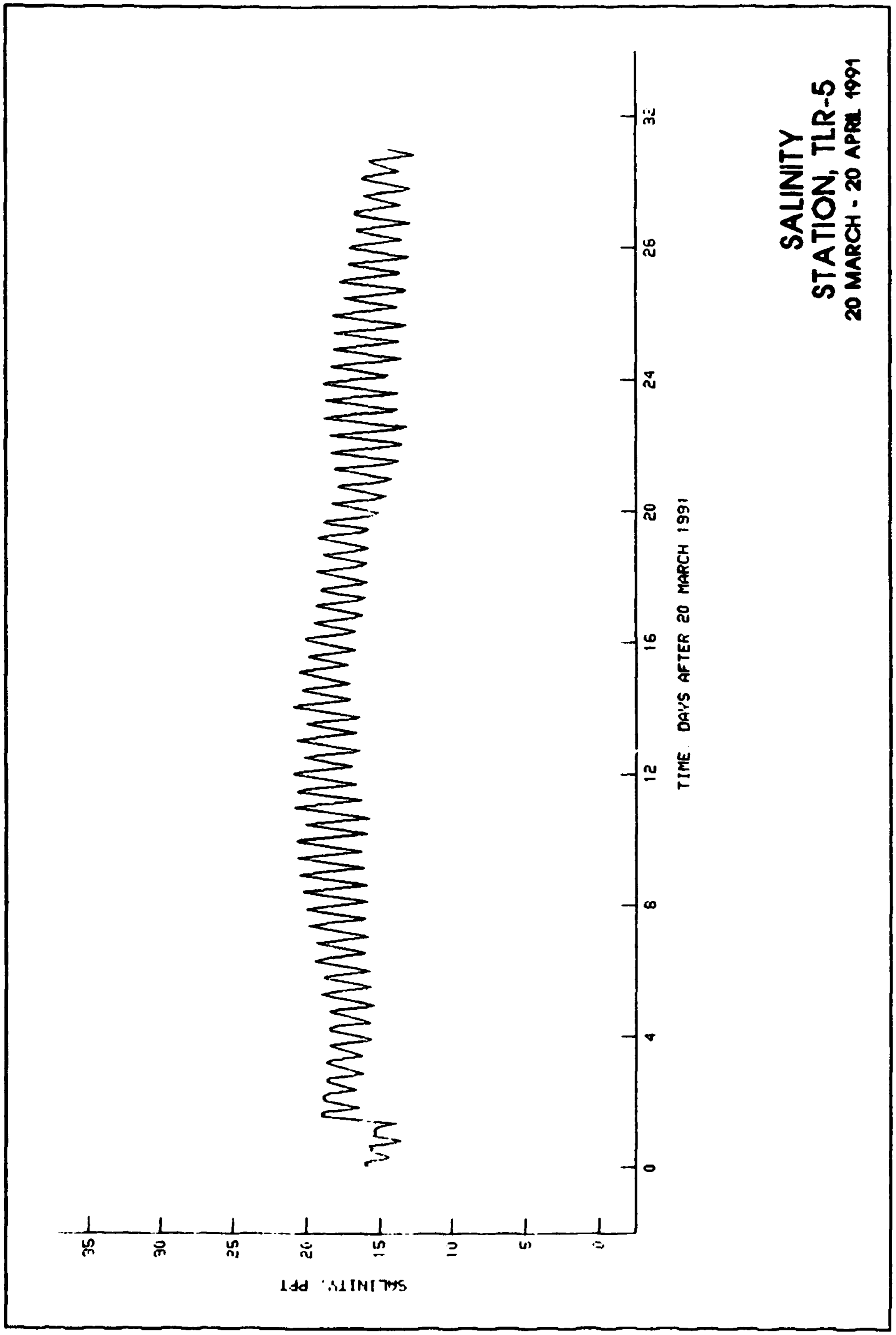
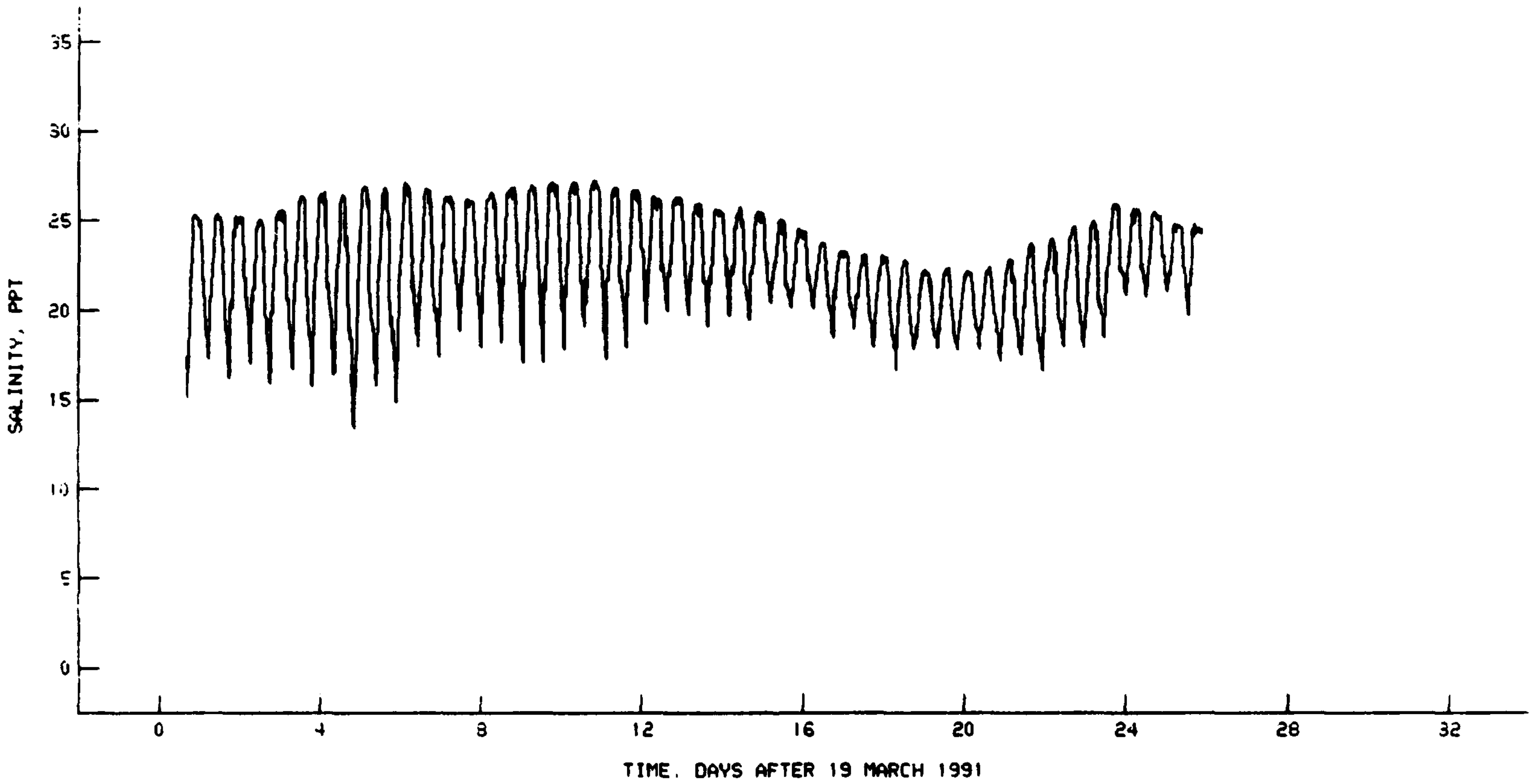
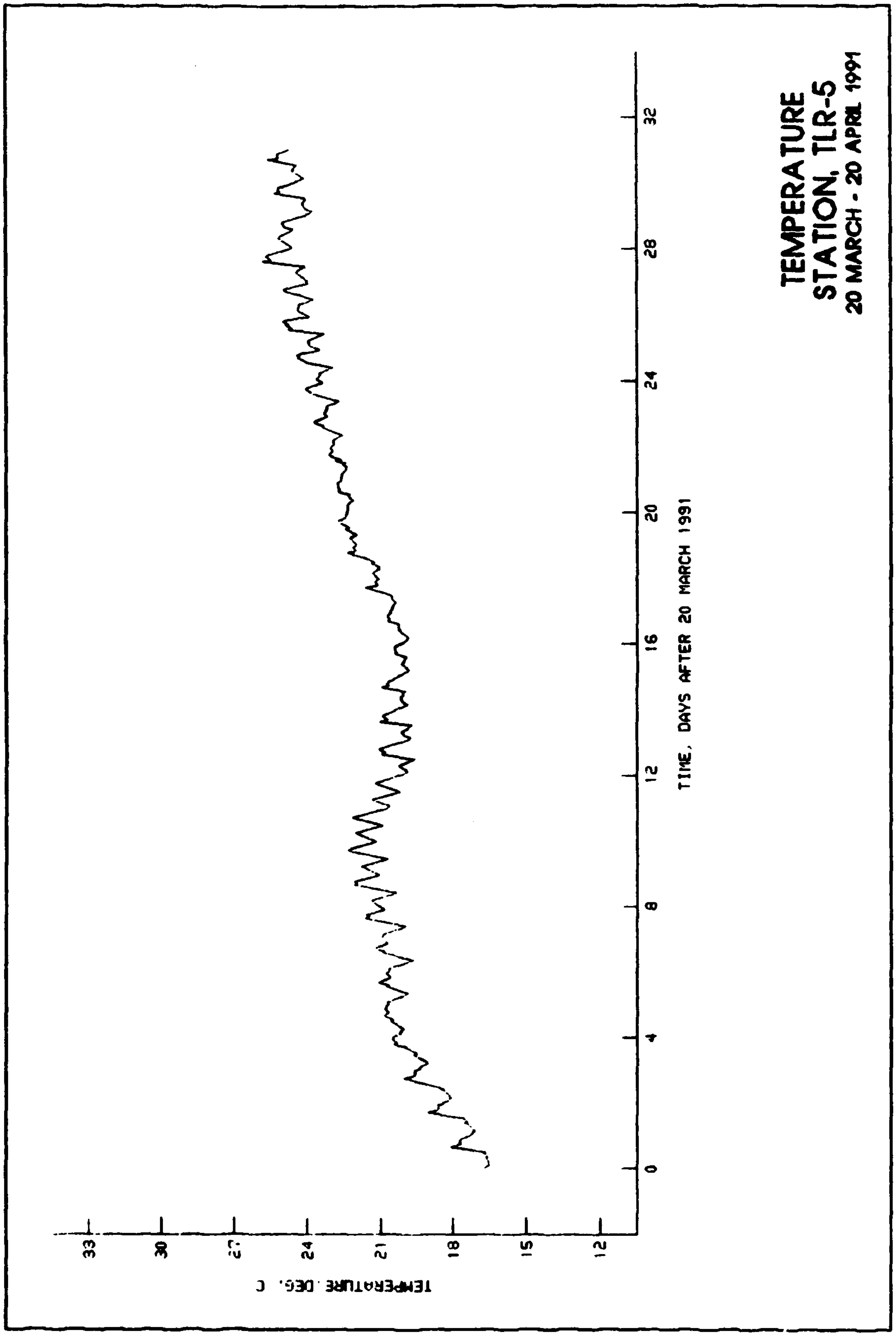

SALINITY
STATION, TLR-5
20 MARCH - 20 APRIL 1991
SALINITY, PPT
TIME, DAYS AFTER 20 MARCH 1991
0
5
10
15
20
25
30
35
0
4
8
12
16
20
24
28
32

PLATE 3



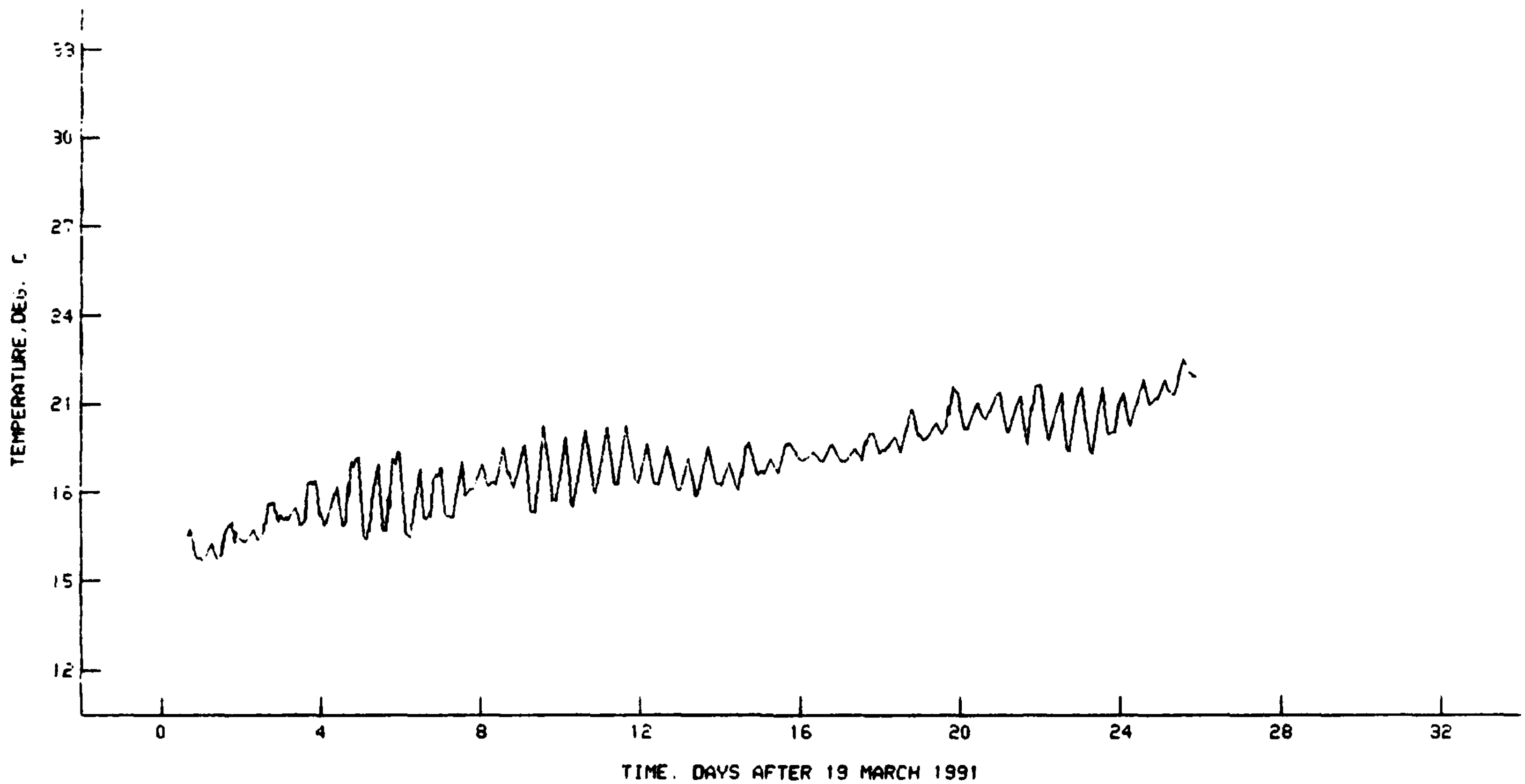
SALINITY
STATION, TLR-7
19 MARCH - 13 APRIL 1991

PLATE 4



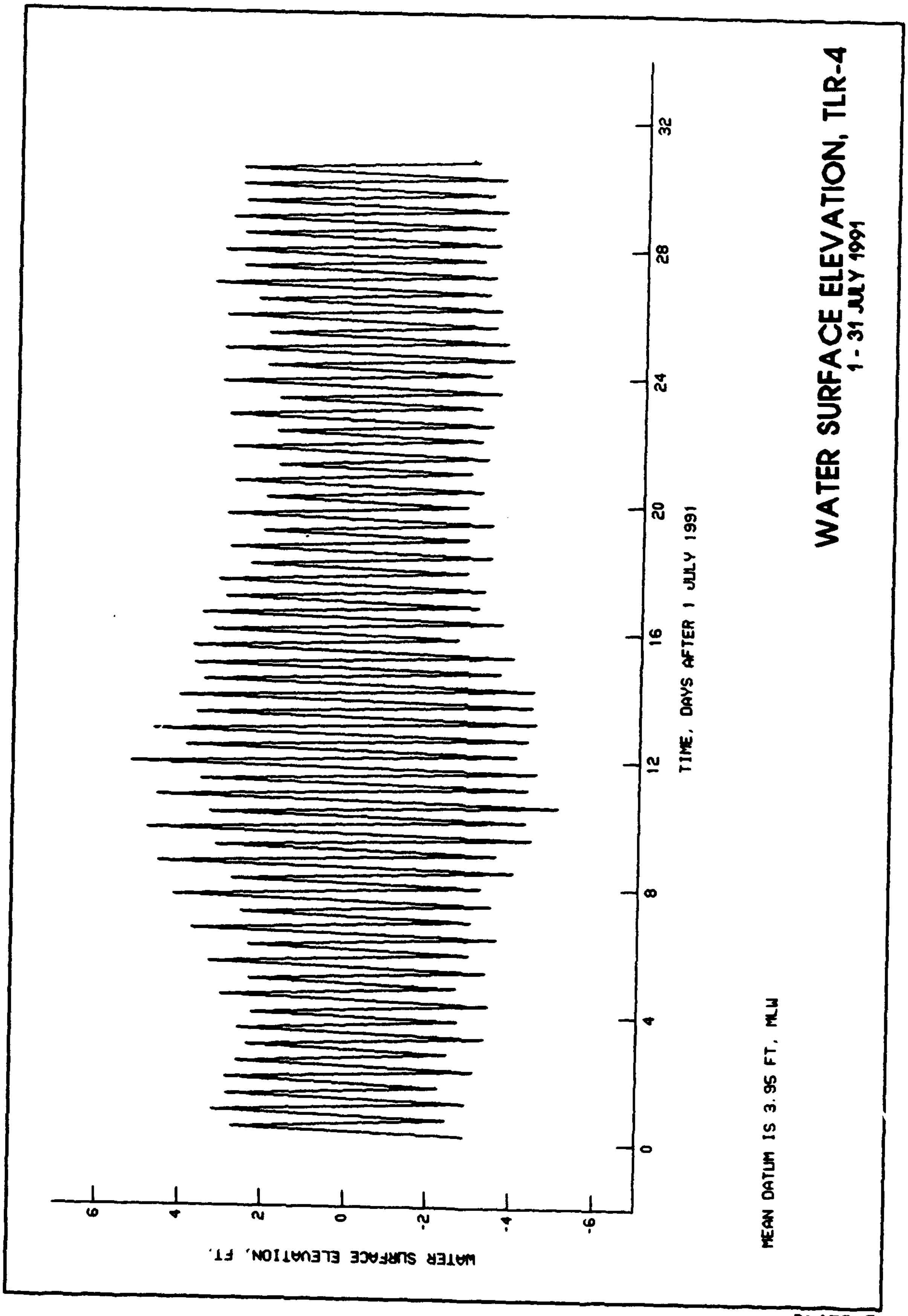
TEMPERATURE
STATION, TLR-5
20 MARCH - 20 APRIL 1991

PLATE 5



TEMPERATURE
STATION, TLR-7
19 MARCH - 13 APRIL 1991

PLATE 6


WATER SURFACE ELEVATION, TLR-4
1 - 31 JULY 1991
TIME, DAYS AFTER 1 JULY 1991
WATER SURFACE ELEVATION, FT.
MEAN DATUM IS 3.95 FT, MLW
0
4
8
12
16
20
24
28
32
6
4
2
0
-2
-4
-6

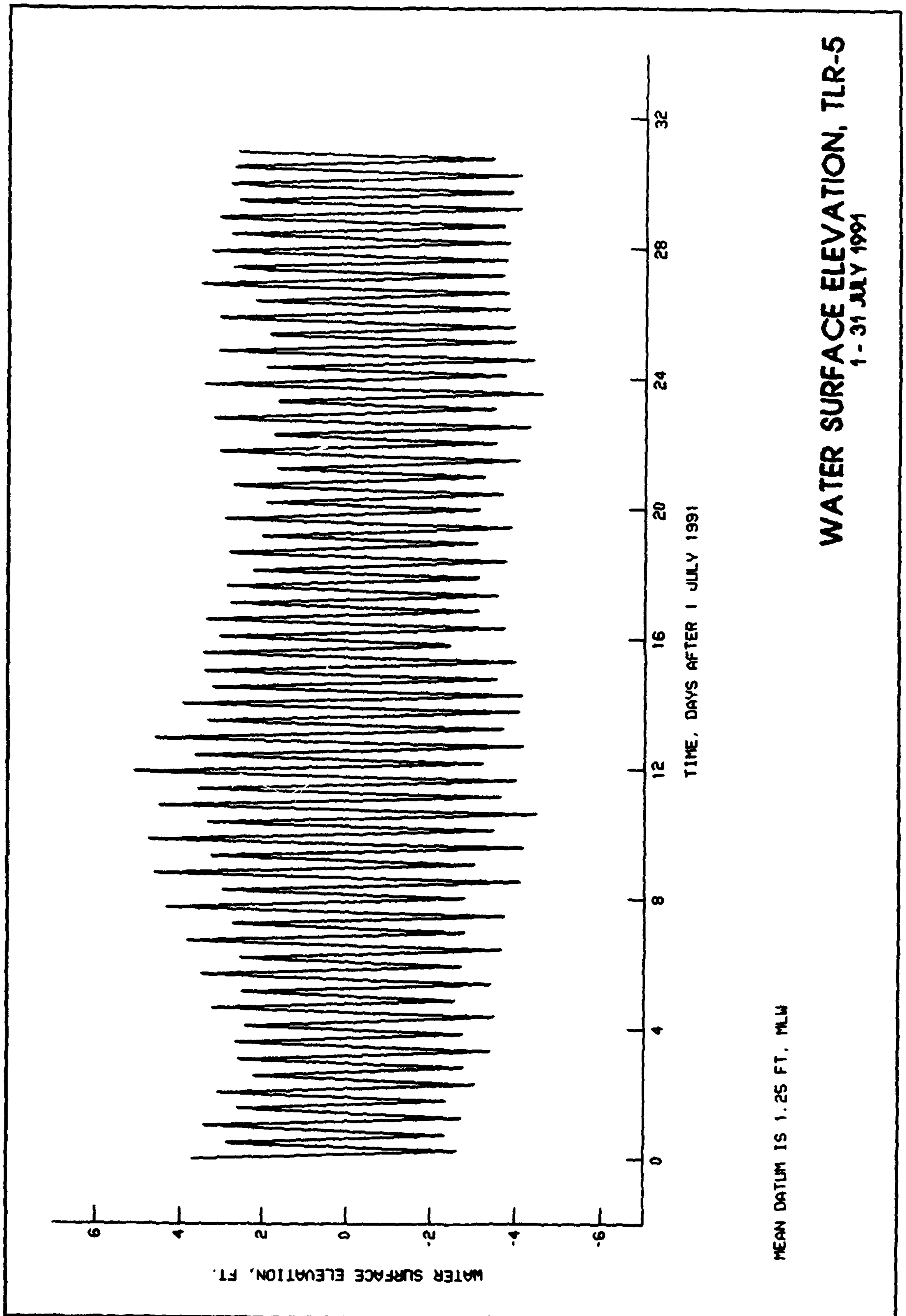
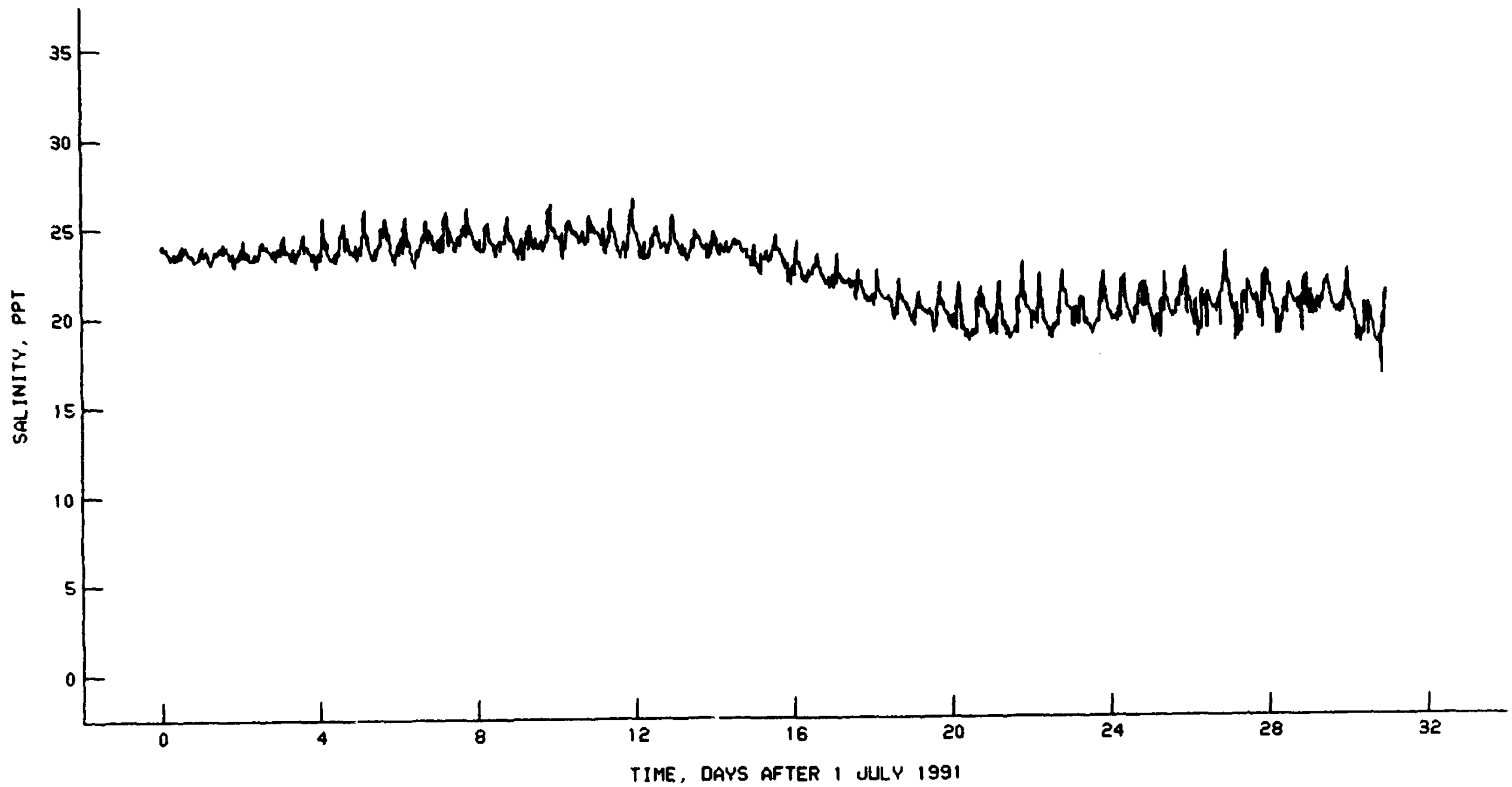

WATER SURFACE ELEVATION, TLR-5
1 - 31 JULY 1991
TIME, DAYS AFTER 1 JULY 1991
WATER SURFACE ELEVATION, FT.
MEAN DATUM IS 1.25 FT. MLW
0
4
8
12
16
20
24
28
32
6
4
2
0
-2
-4
-6

PLATE 8



SALINITY
STATION, TLR-4
1 - 31 JULY 1991

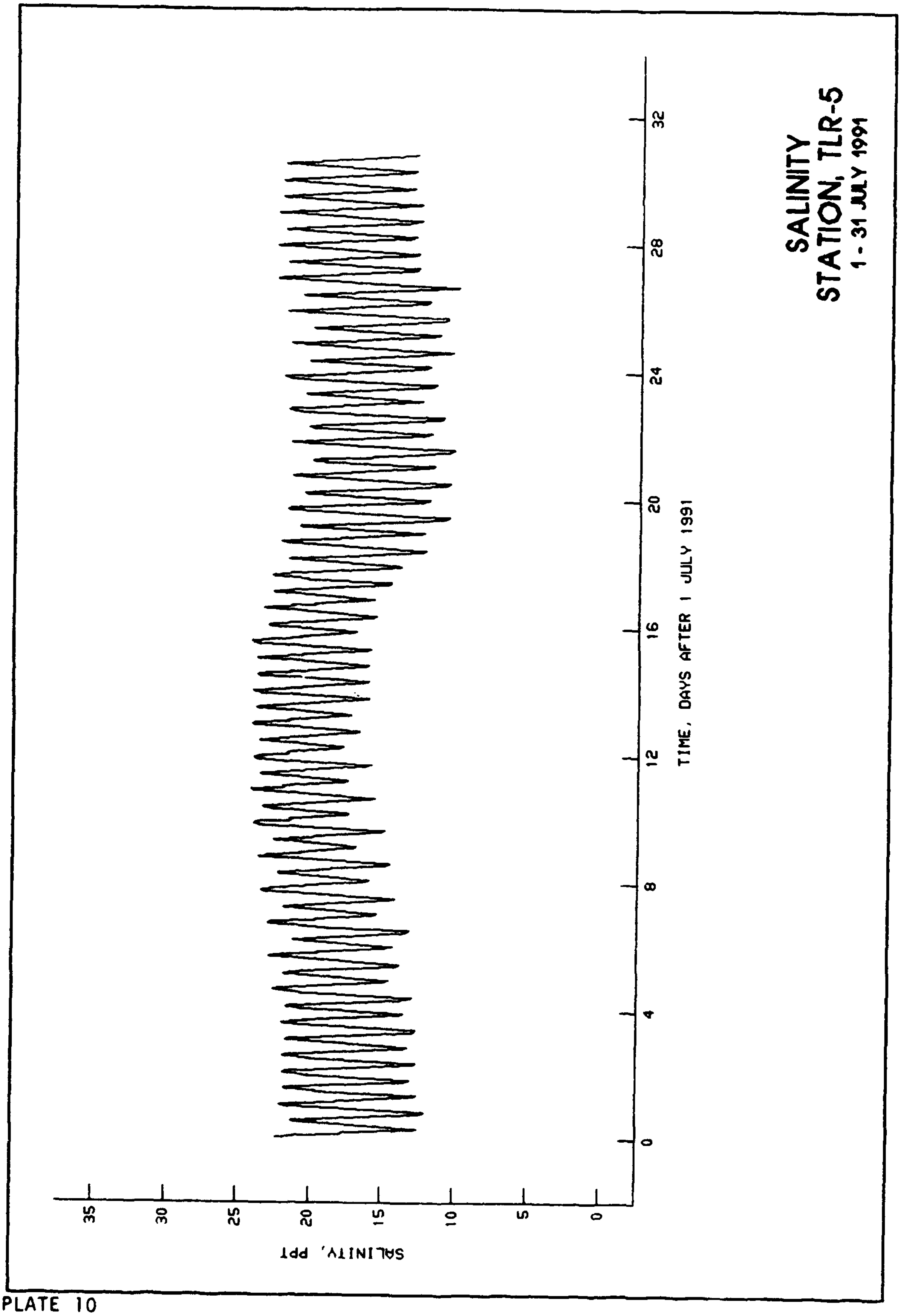
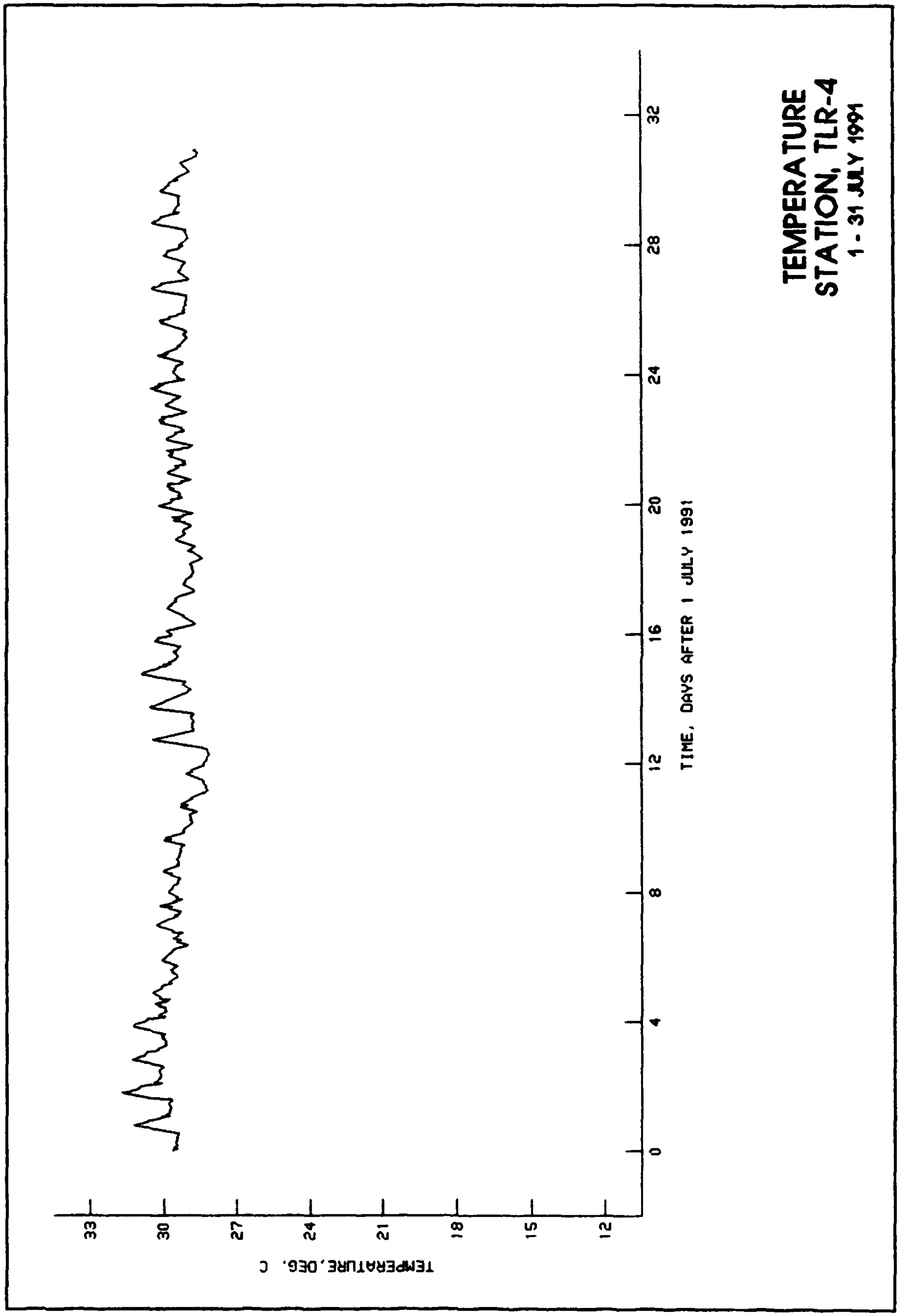
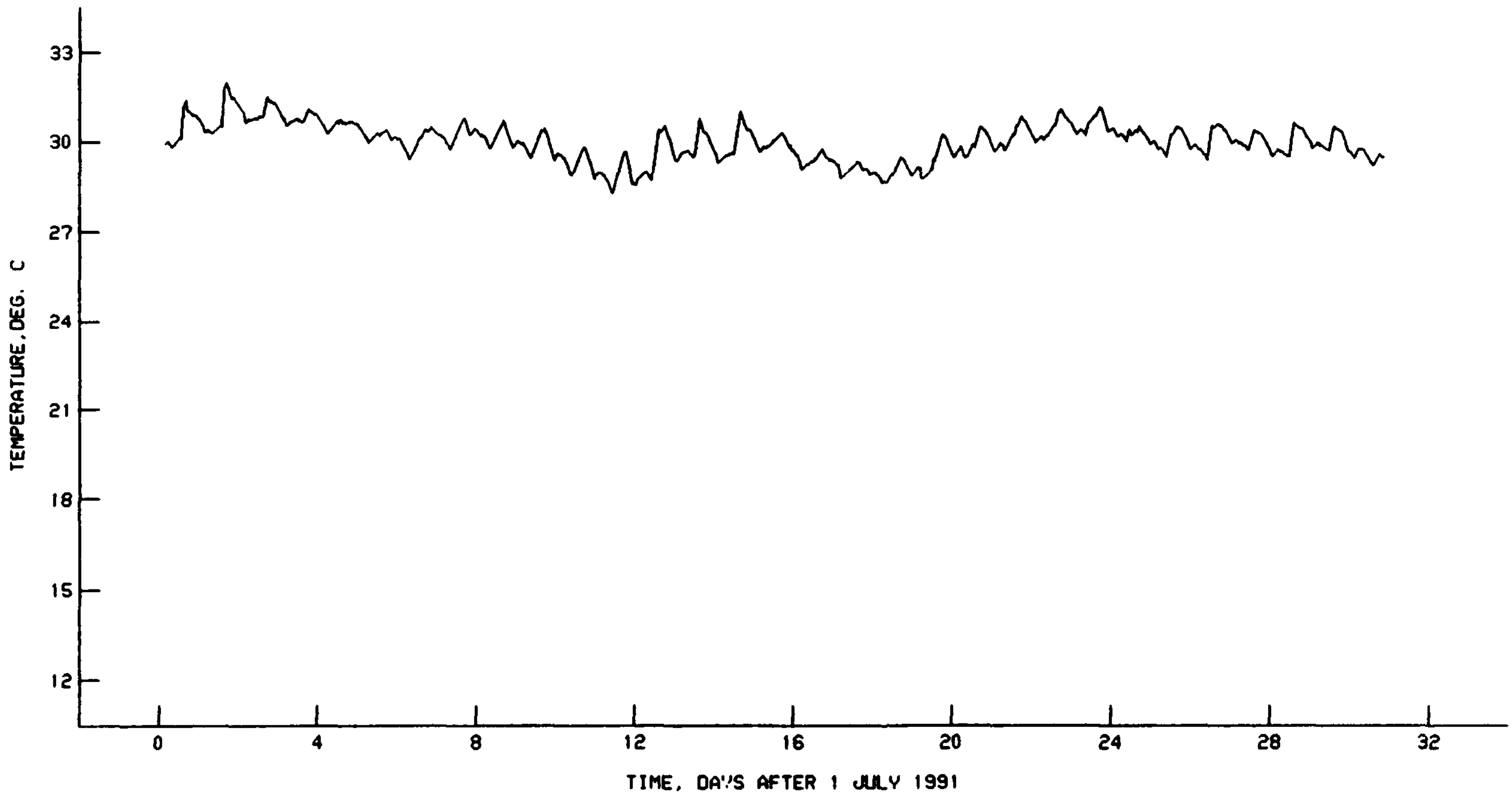

SALINITY
STATION, TLR-5
1 - 31 JULY 1991
SALINITY, PPT
0
5
10
15
20
25
30
35
TIME, DAYS AFTER 1 JULY 1991
0
4
8
12
16
20
24
28
32

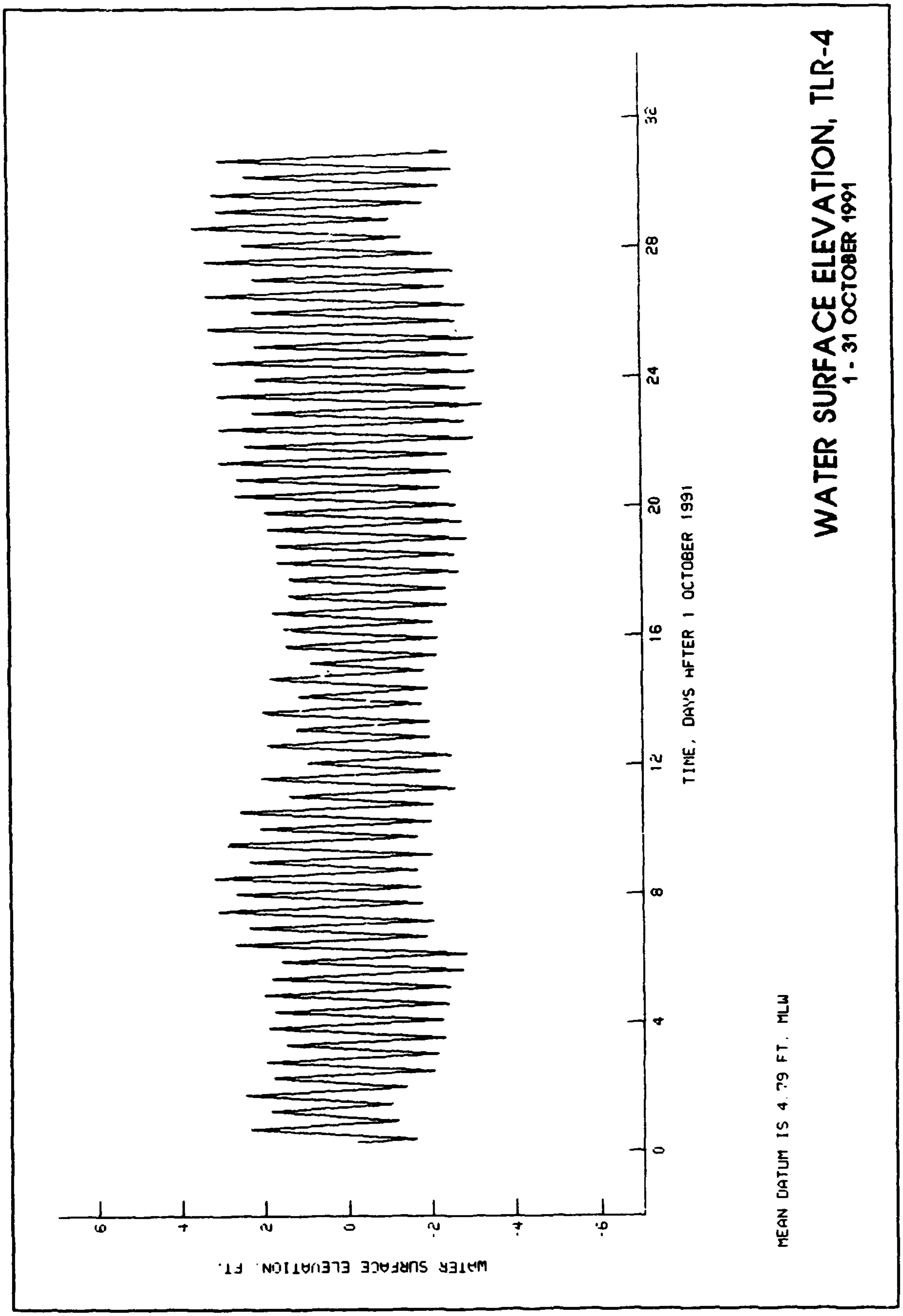
PLATE 10

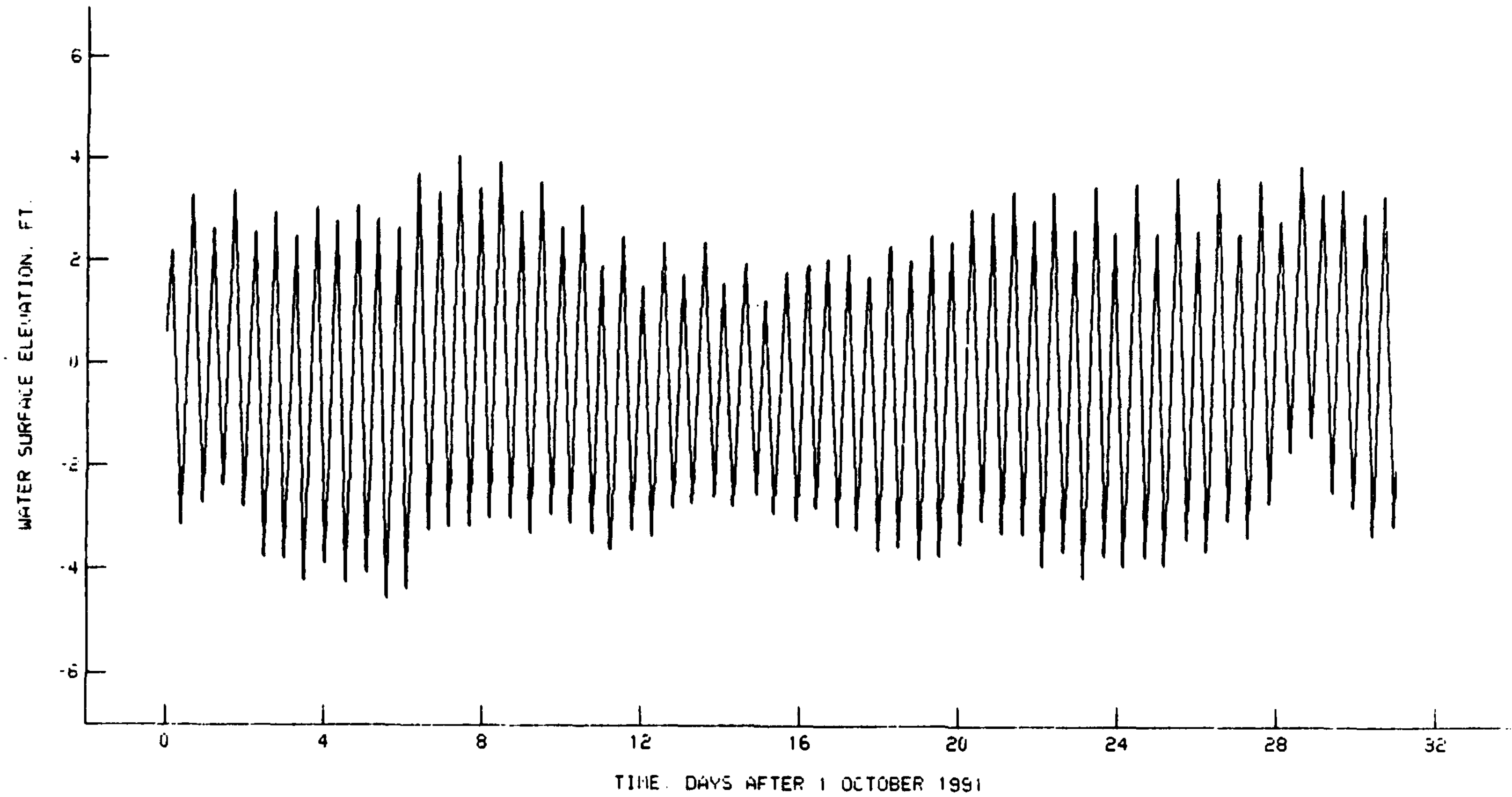

TEMPERATURE
STATION, TLR-4
1 - 31 JULY 1991
TEMPERATURE, DEG. C
33
30
27
24
21
18
15
12
TIME, DAYS AFTER 1 JULY 1991
0
4
8
12
16
20
24
28
32



TEMPERATURE
STATION, TLR-5
1 - 31 JULY 1991

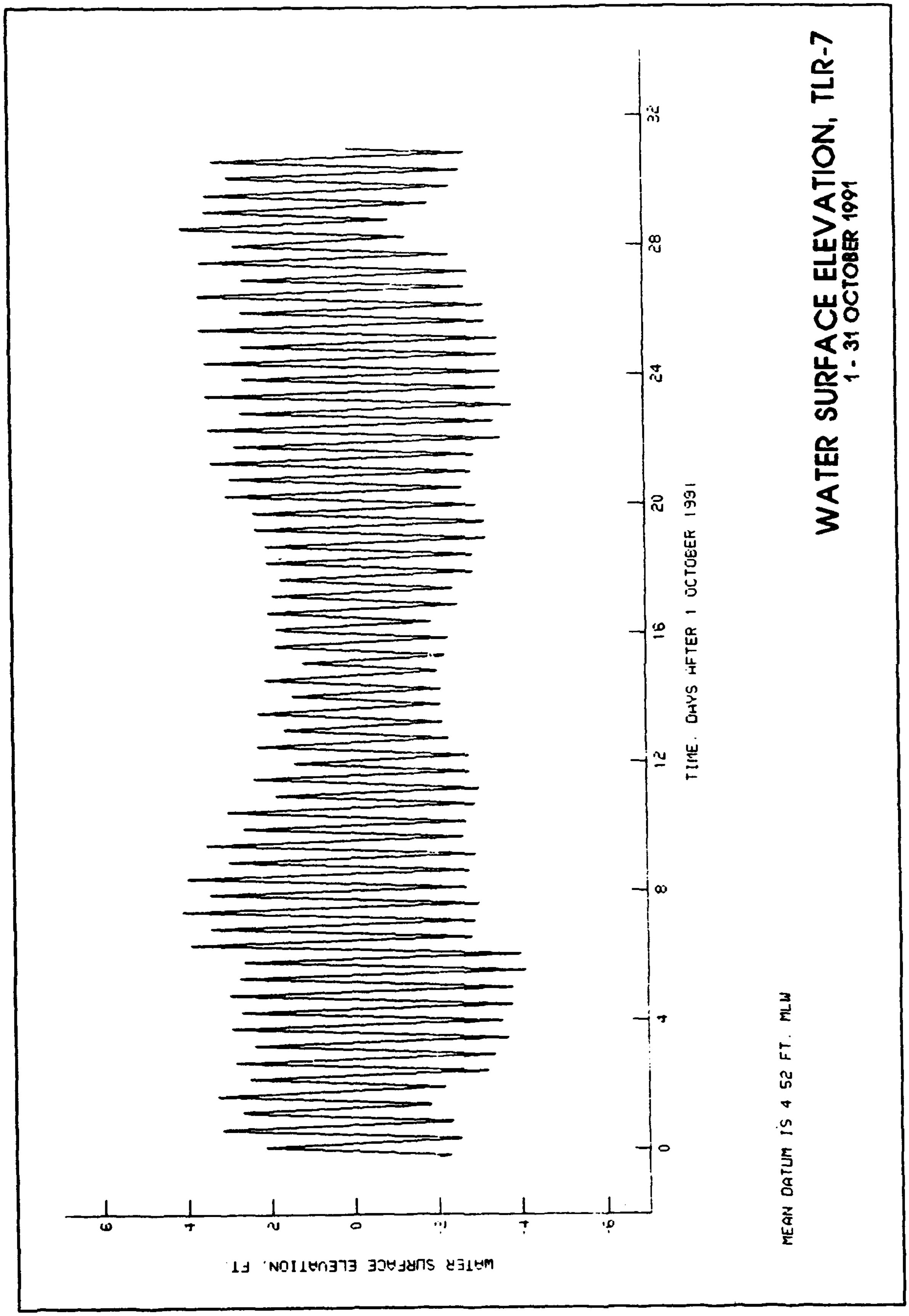
PLATE 12

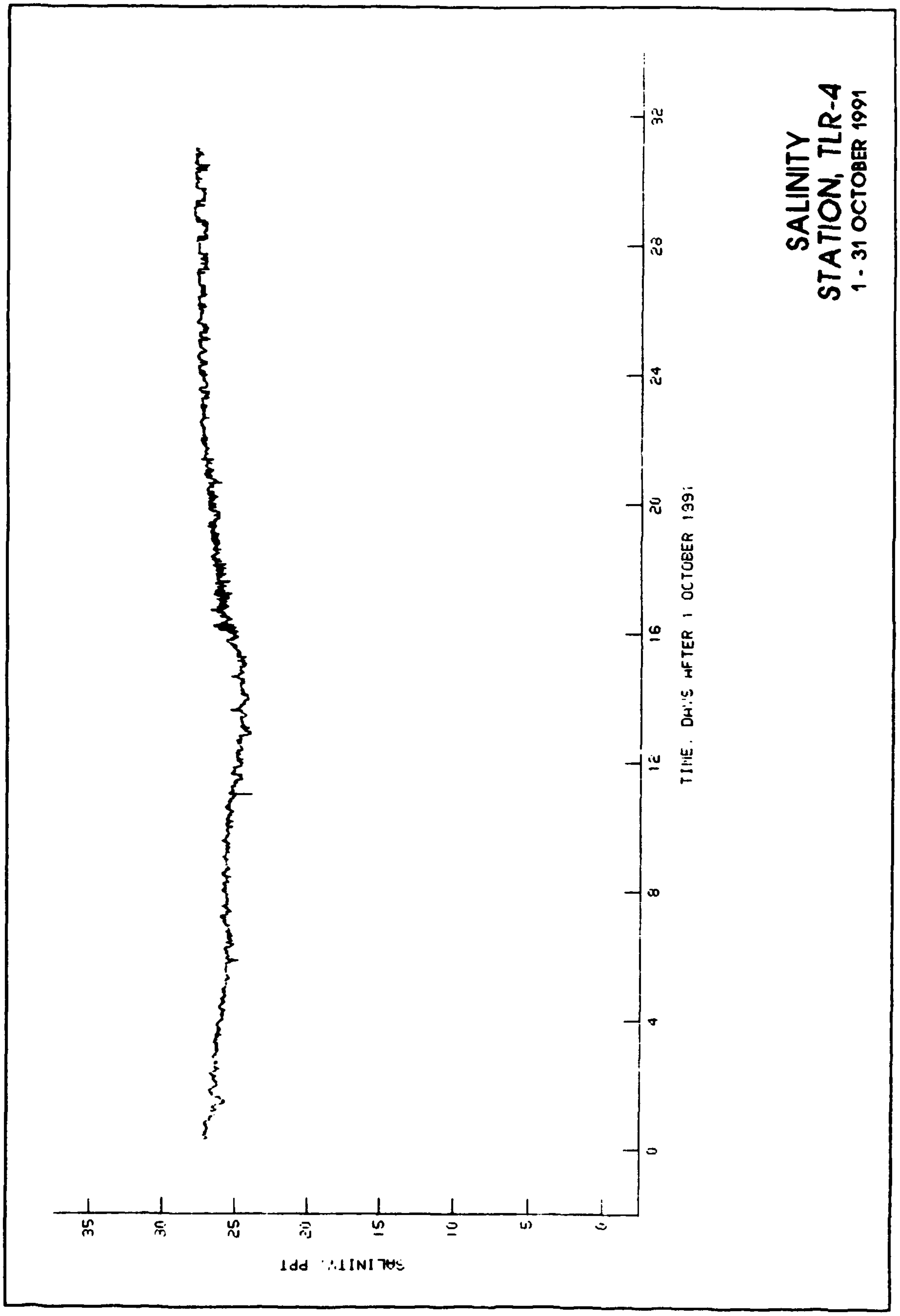

WATER SURFACE ELEVATION, TLR-4
1 - 31 OCTOBER 1991
TIME, DAYS AFTER 1 OCTOBER 1991
WATER SURFACE ELEVATION, FT.
MEAN DATUM IS 4.79 FT. MLW
0
4
8
12
16
20
24
28
32
6
4
2
0
-2
-4
-6



MEAN DATUM IS 2.74 FT MLW

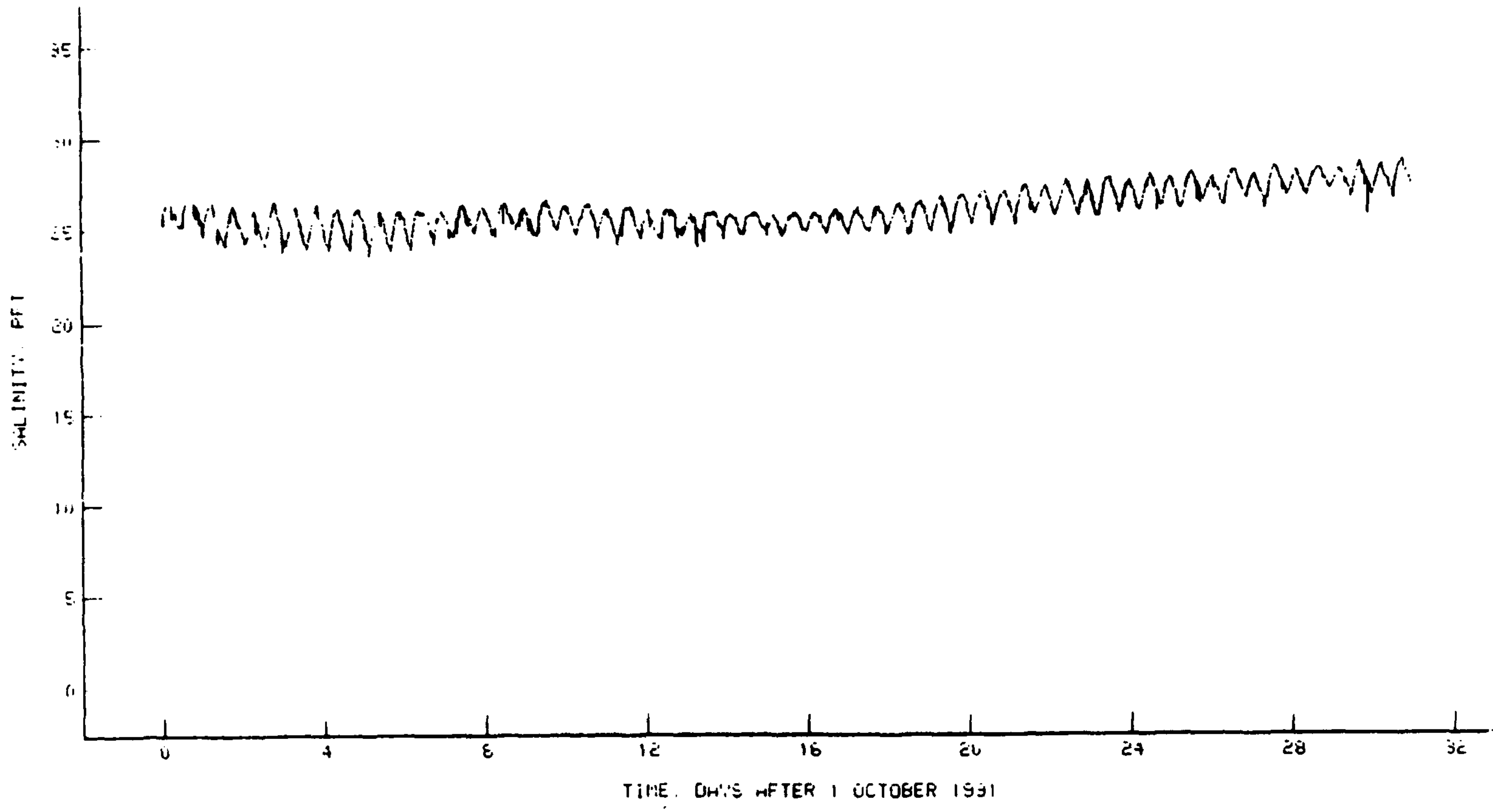
WATER SURFACE ELEVATION, TLR-5
1 - 31 OCTOBER 1991


WATER SURFACE ELEVATION, TLR-7
1 - 31 OCTOBER 1991
WATER SURFACE ELEVATION, FT.
TIME, DAYS AFTER 1 OCTOBER 1991
MEAN DATUM IS 4 52 FT. MLW
6
4
2
0
-2
-4
-6
0
4
8
12
16
20
24
28
32



SALINITY
STATION, TLR-4
1 - 31 OCTOBER 1991

PLATE 16



SALINITY
STATION, TLR-5
1 - 31 OCTOBER 1991

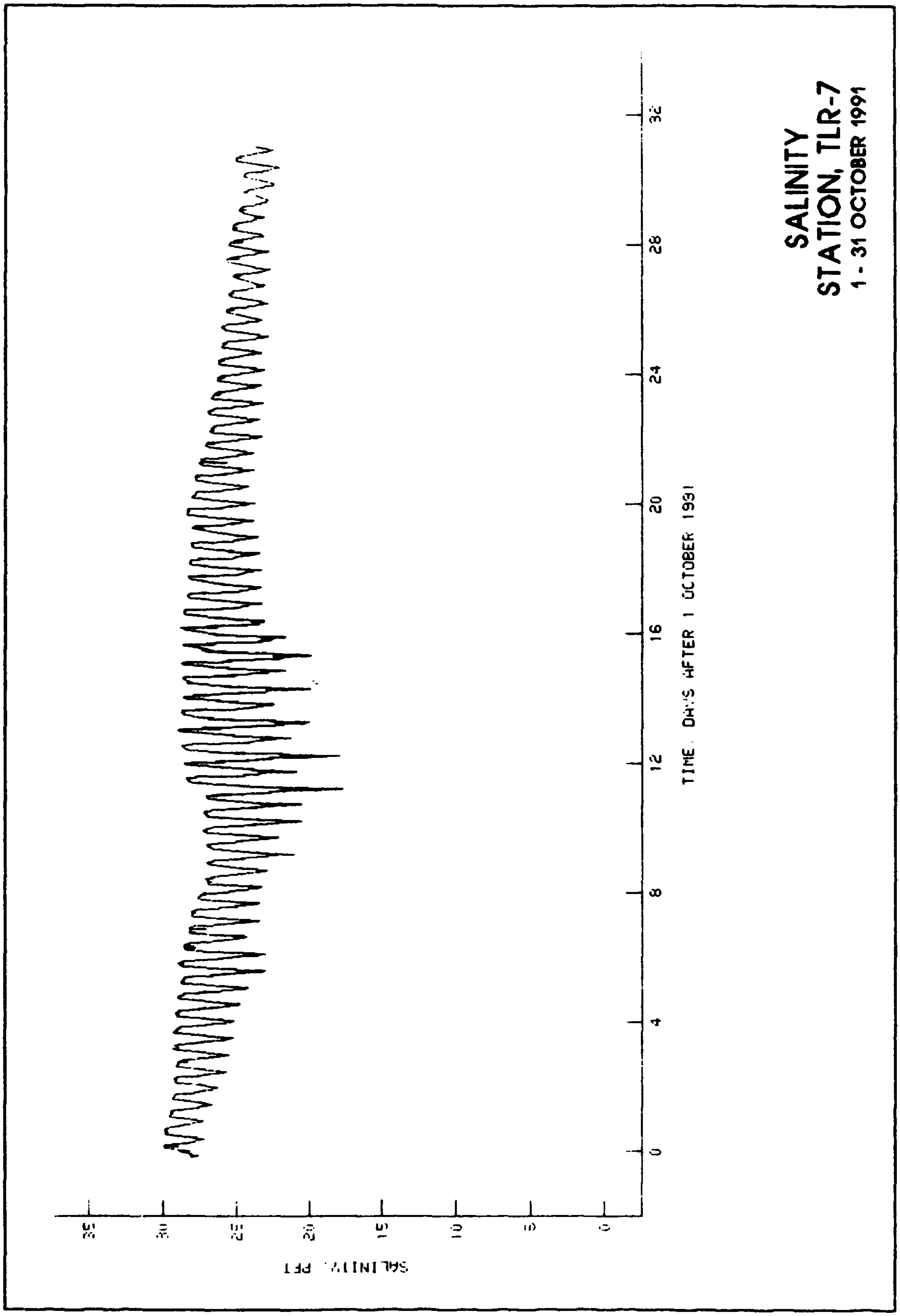

SALINITY
STATION, TLR-7
1 - 31 OCTOBER 1991
TIME, DAYS AFTER 1 OCTOBER 1991
SALINITY, PPT
0
4
8
12
16
20
24
28
32
0
5
10
15
20
25
30
35

PLATE 18

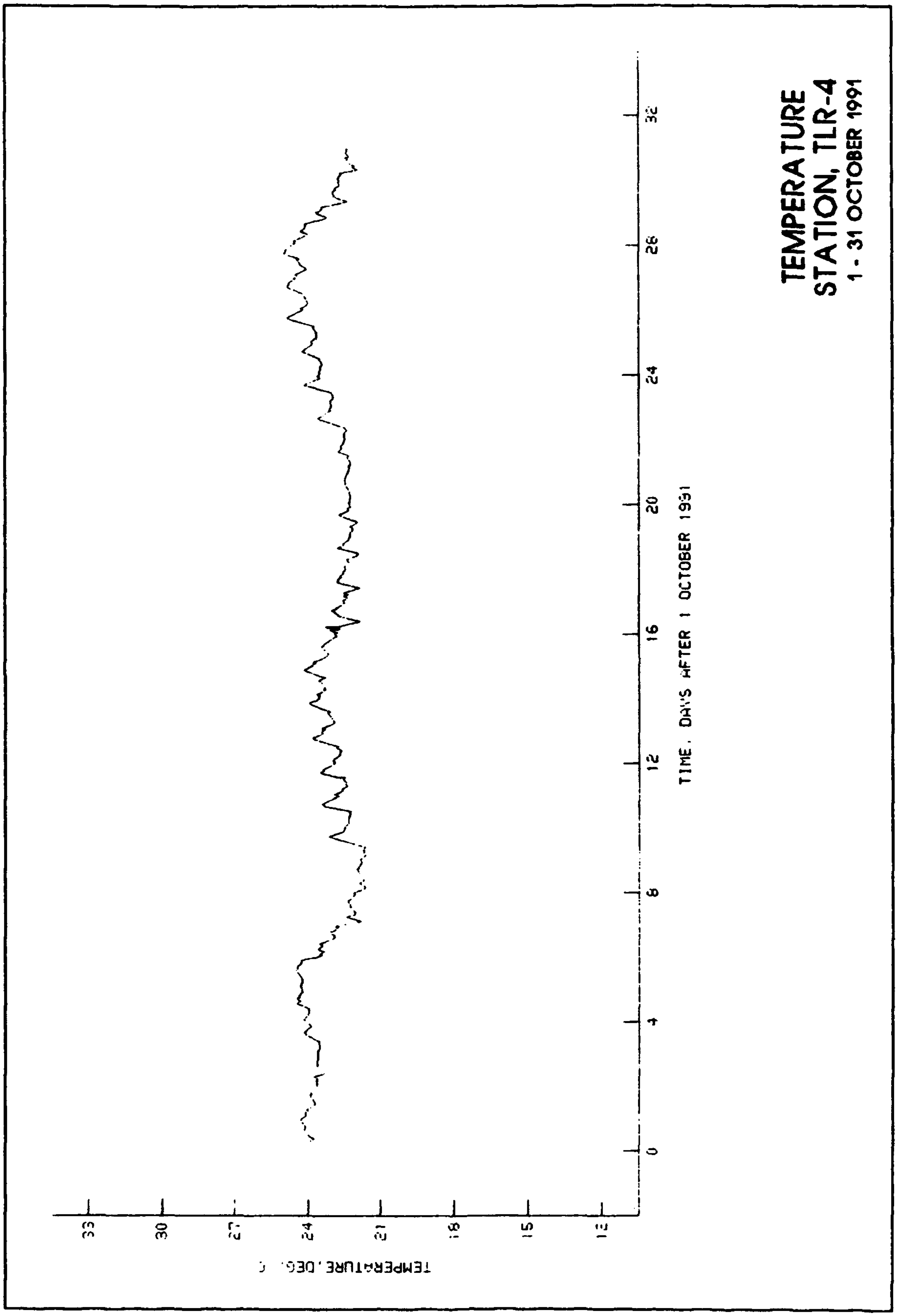
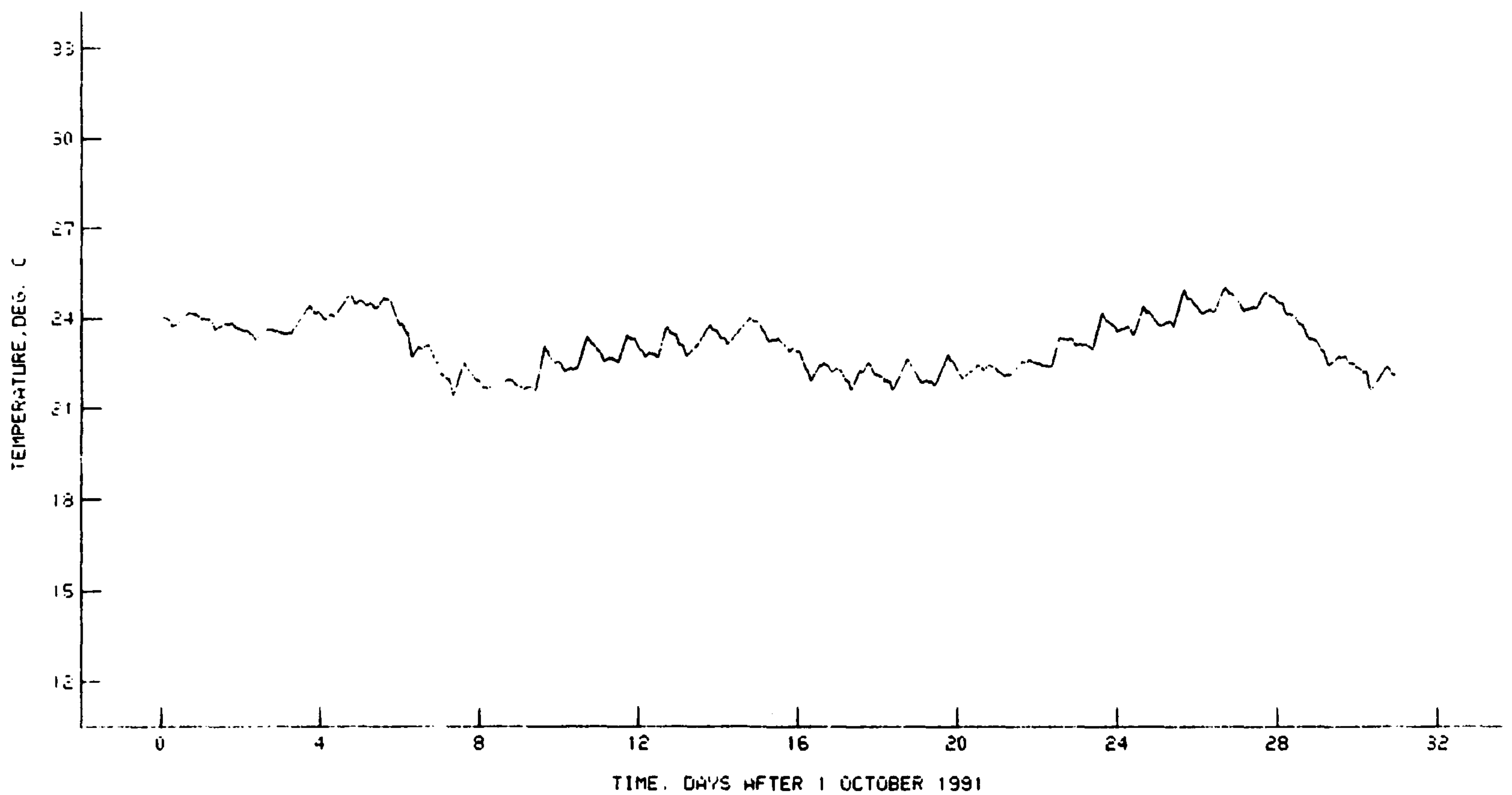
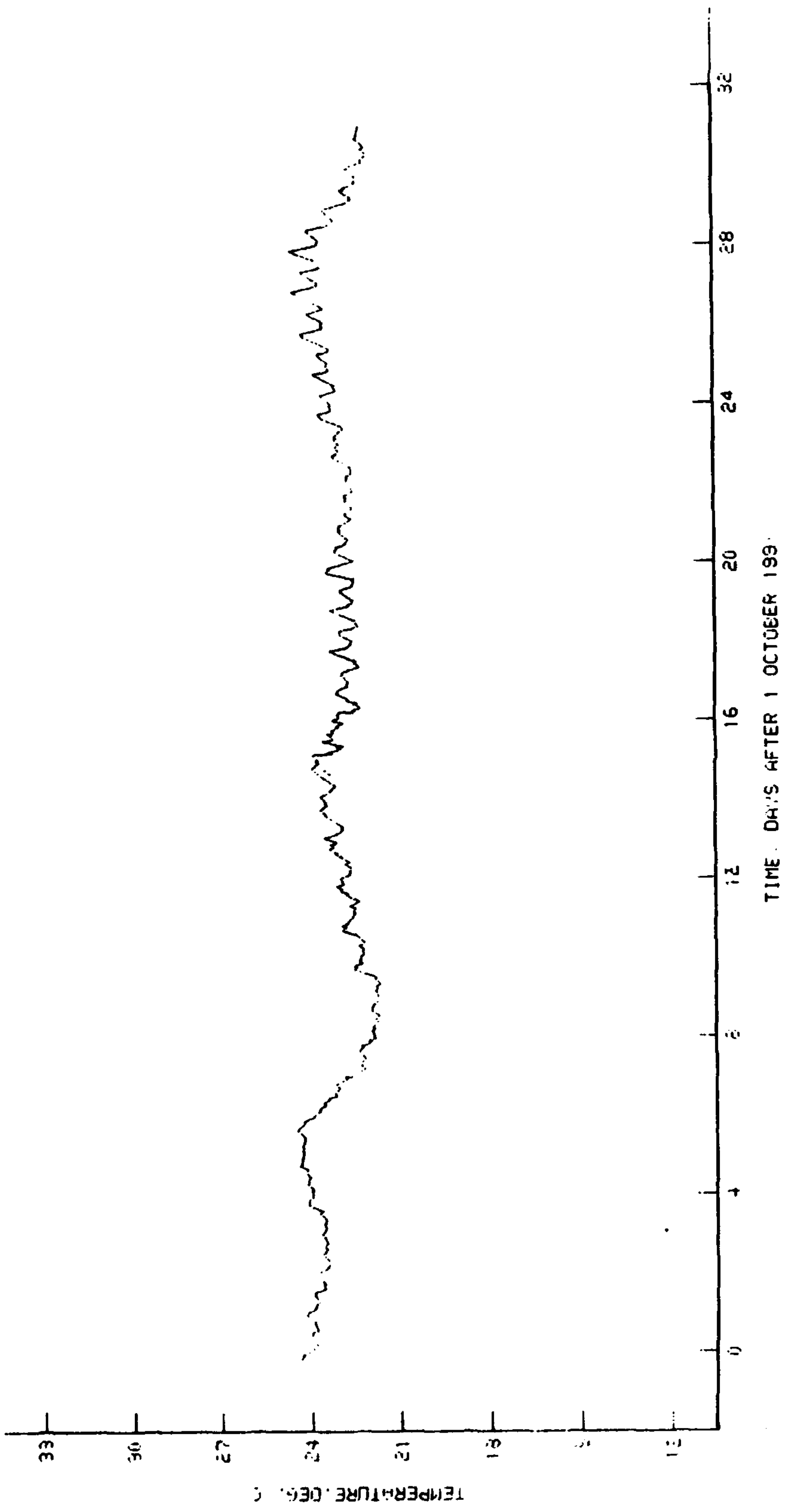

TEMPERATURE
STATION, TLR-4
1 - 31 OCTOBER 1991
TIME, DAYS AFTER 1 OCTOBER 1991
TEMPERATURE, DEG. C
0
4
8
12
16
20
24
28
32
12
15
18
21
24
27
30
33

PLATE 19

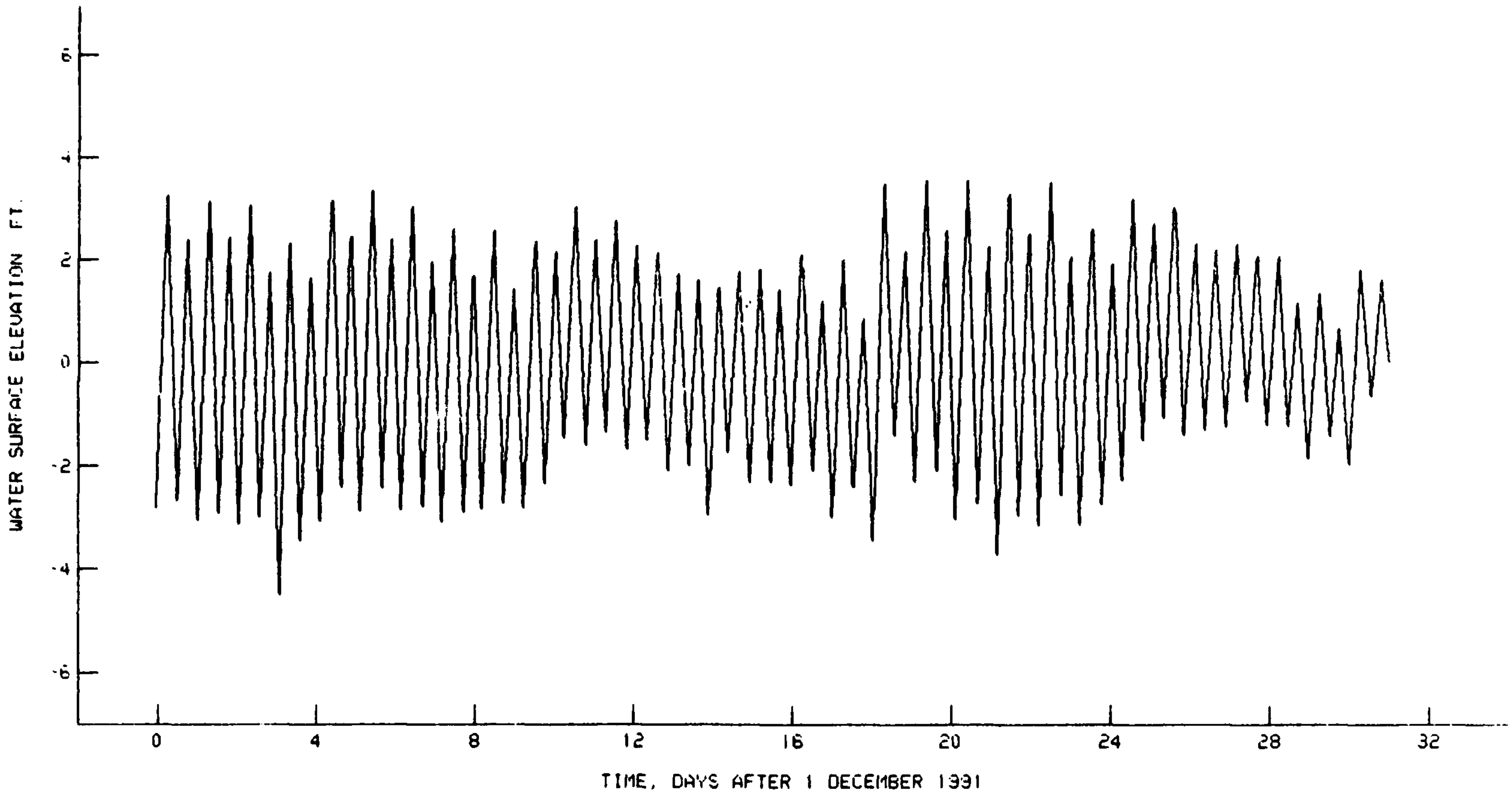


TEMPERATURE
STATION, TLR-5
1 - 31 OCTOBER 1991

PLATE 20

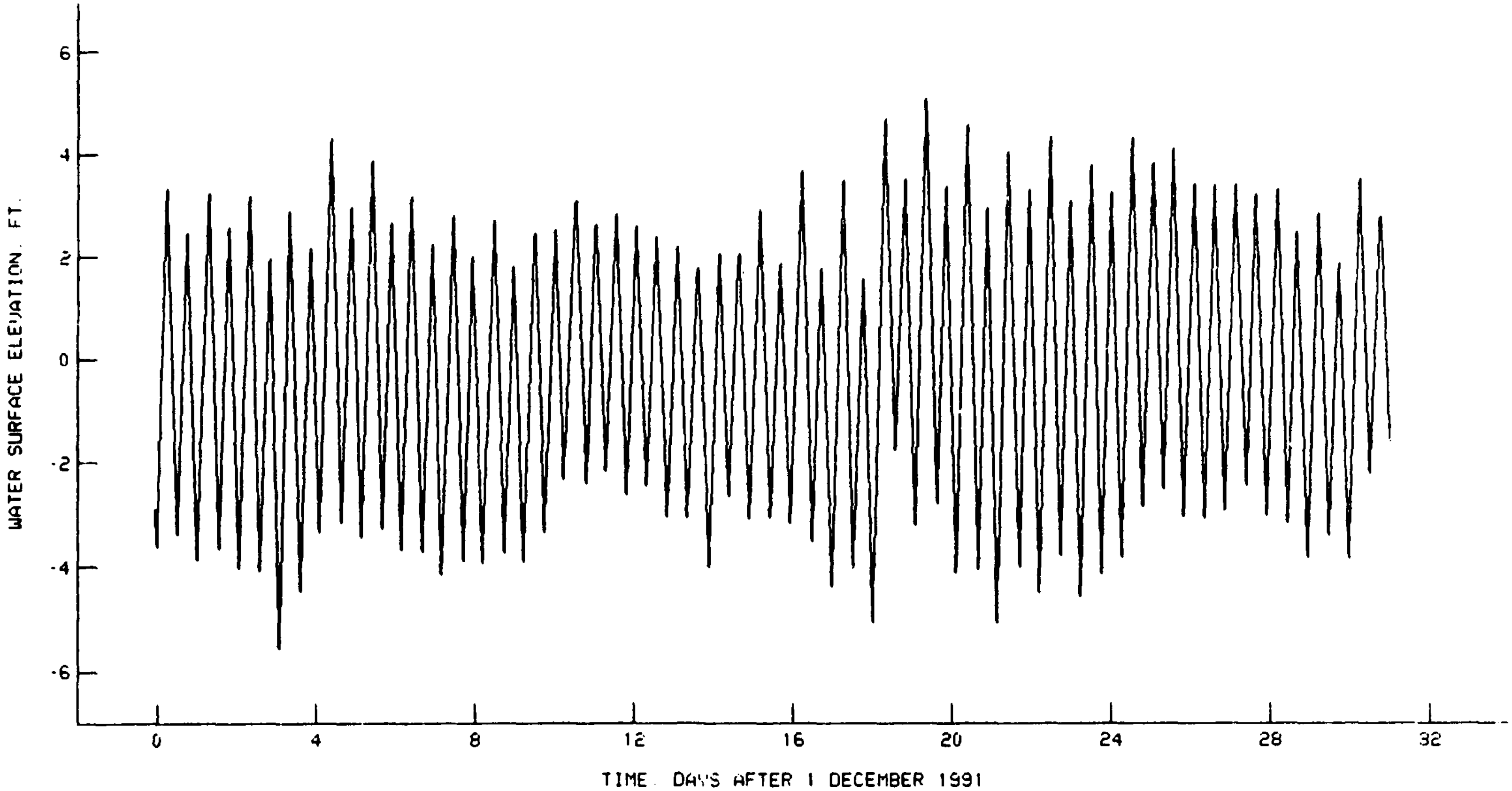


TEMPERATURE
STATION, TLR-7
1 - 31 OCTOBER 1991



MEAN DATUM IS 3.57 FT. MLW

WATER SURFACE ELEVATION, TLR-4
1 - 31 DECEMBER 1991



MEAN DATUM IS 1.65 FT MLW

WATER SURFACE ELEVATION, TLR-5
1 - 31 DECEMBER 1991

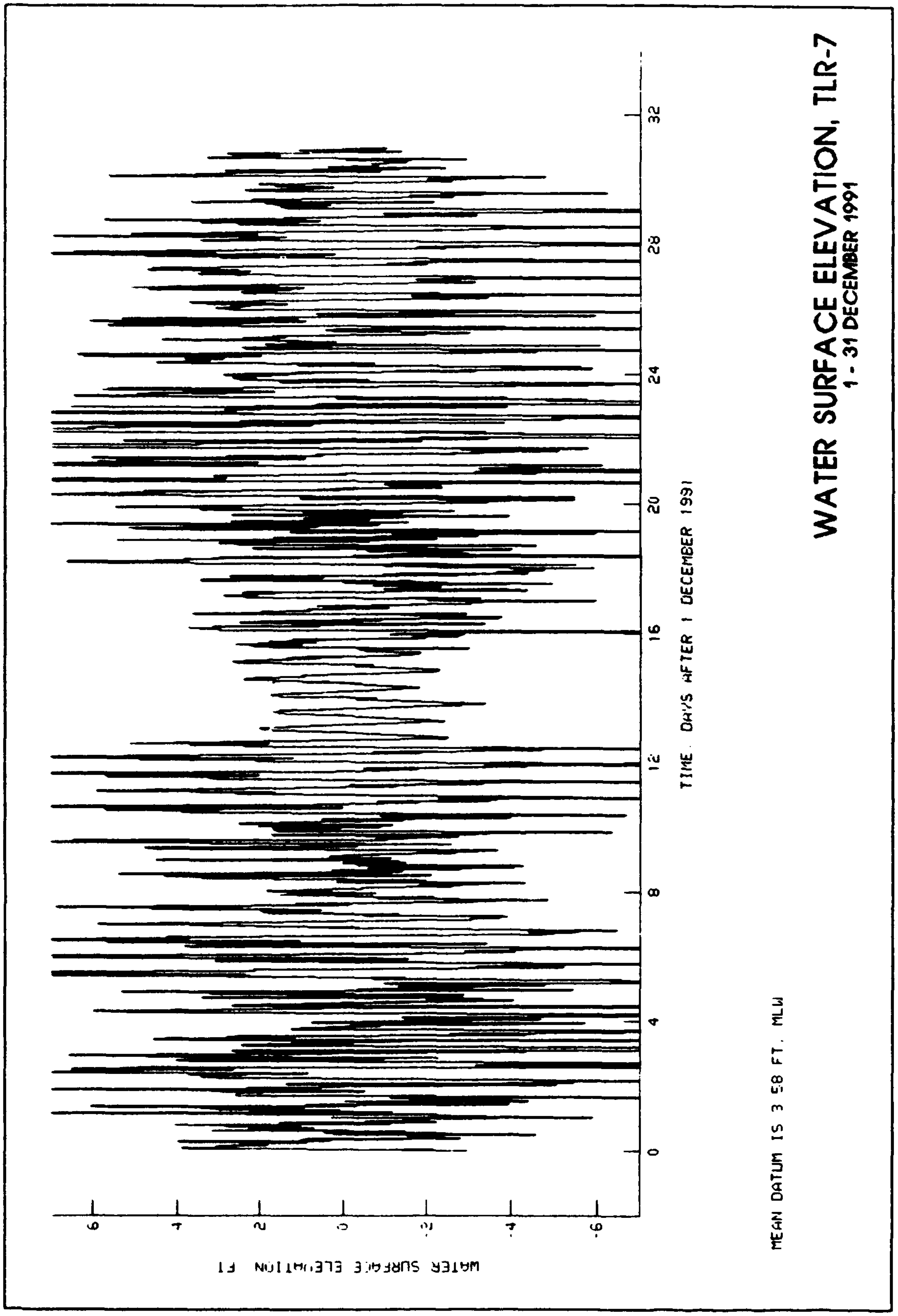
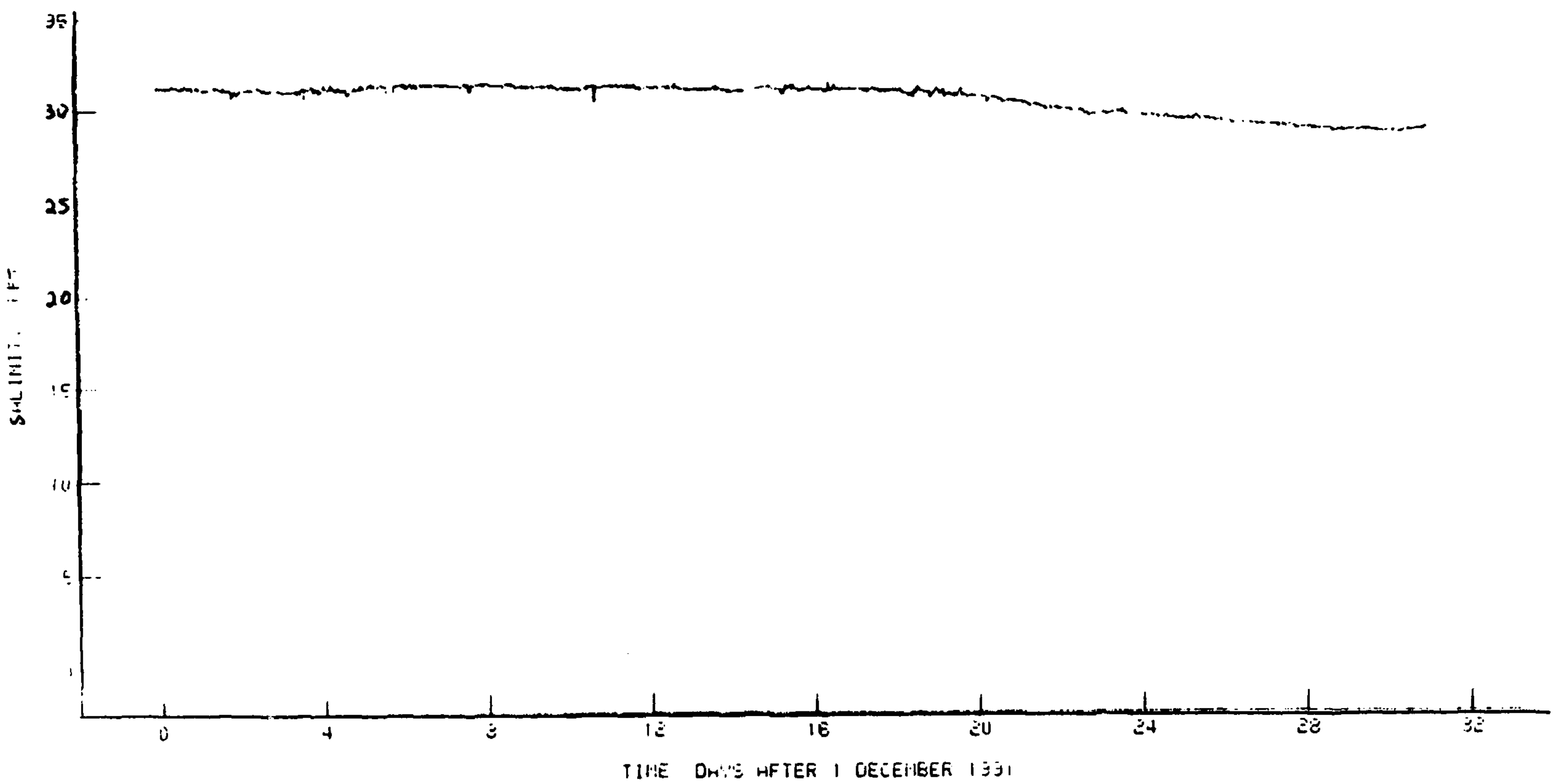
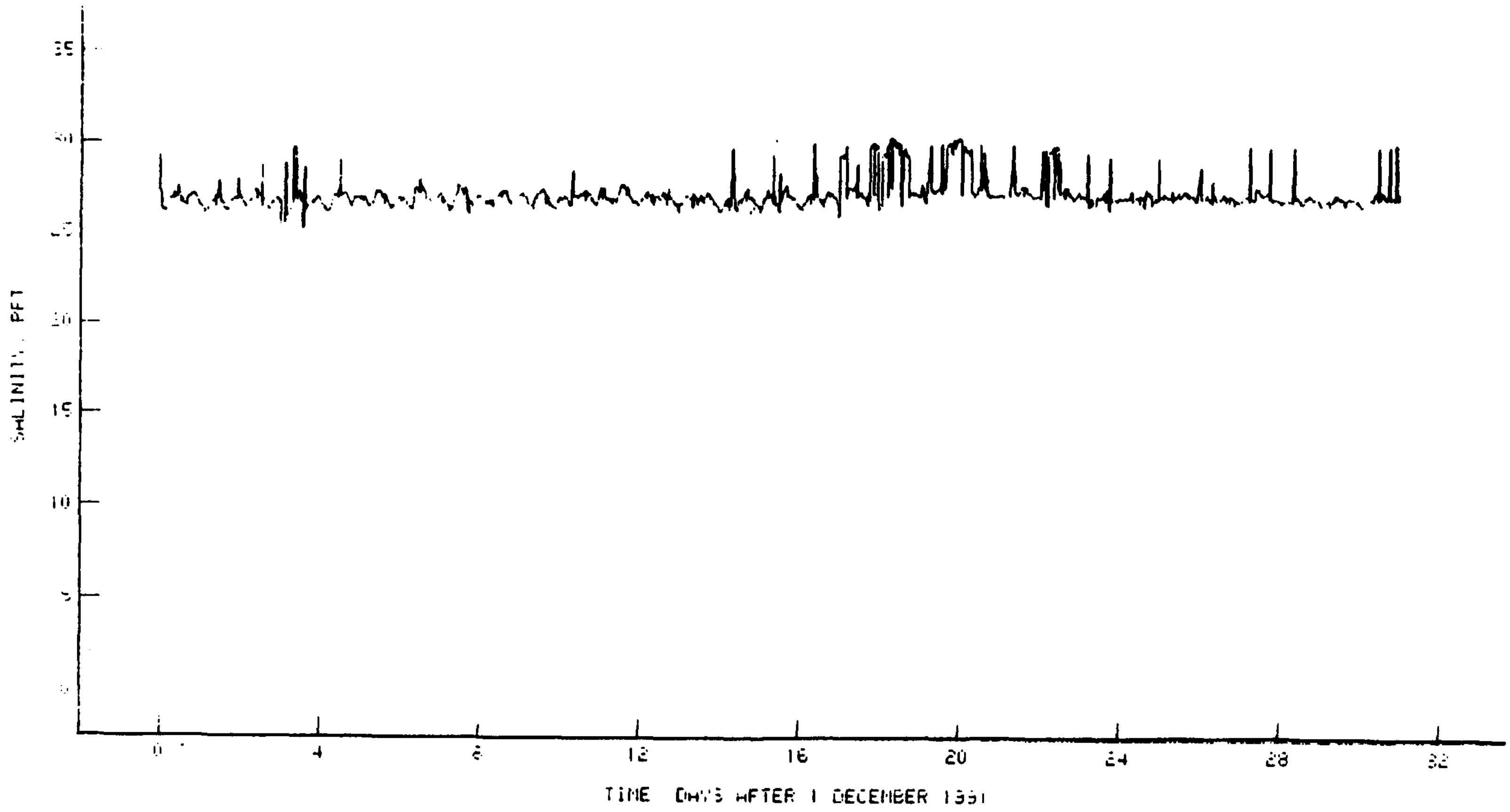

WATER SURFACE ELEVATION, TLR-7
1 - 31 DECEMBER 1991
TIME, DAYS AFTER 1 DECEMBER 1991
WATER SURFACE ELEVATION, FT
MEAN DATUM IS 3.58 FT. MLW
0
4
8
12
16
20
24
28
32
6
4
2
0
-2
-4
-6

PLATE 24

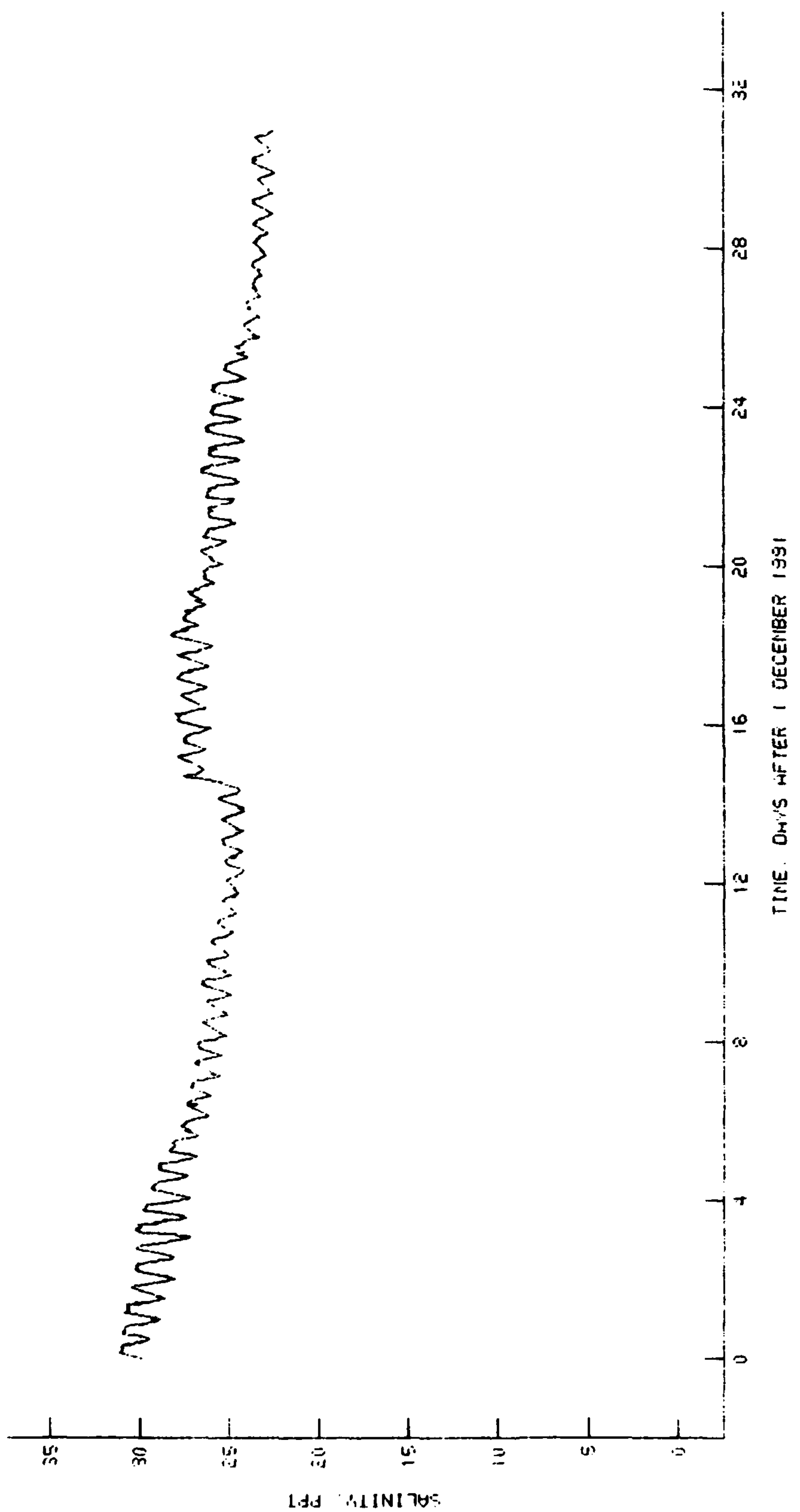


SALINITY
STATION, TLR-4
1 - 31 DECEMBER 1991



SALINITY
STATION, TLR-5
1 - 31 DECEMBER 1991

PLATE 26



SALINITY
STATION, TLR-7
1 - 31 DECEMBER 1991

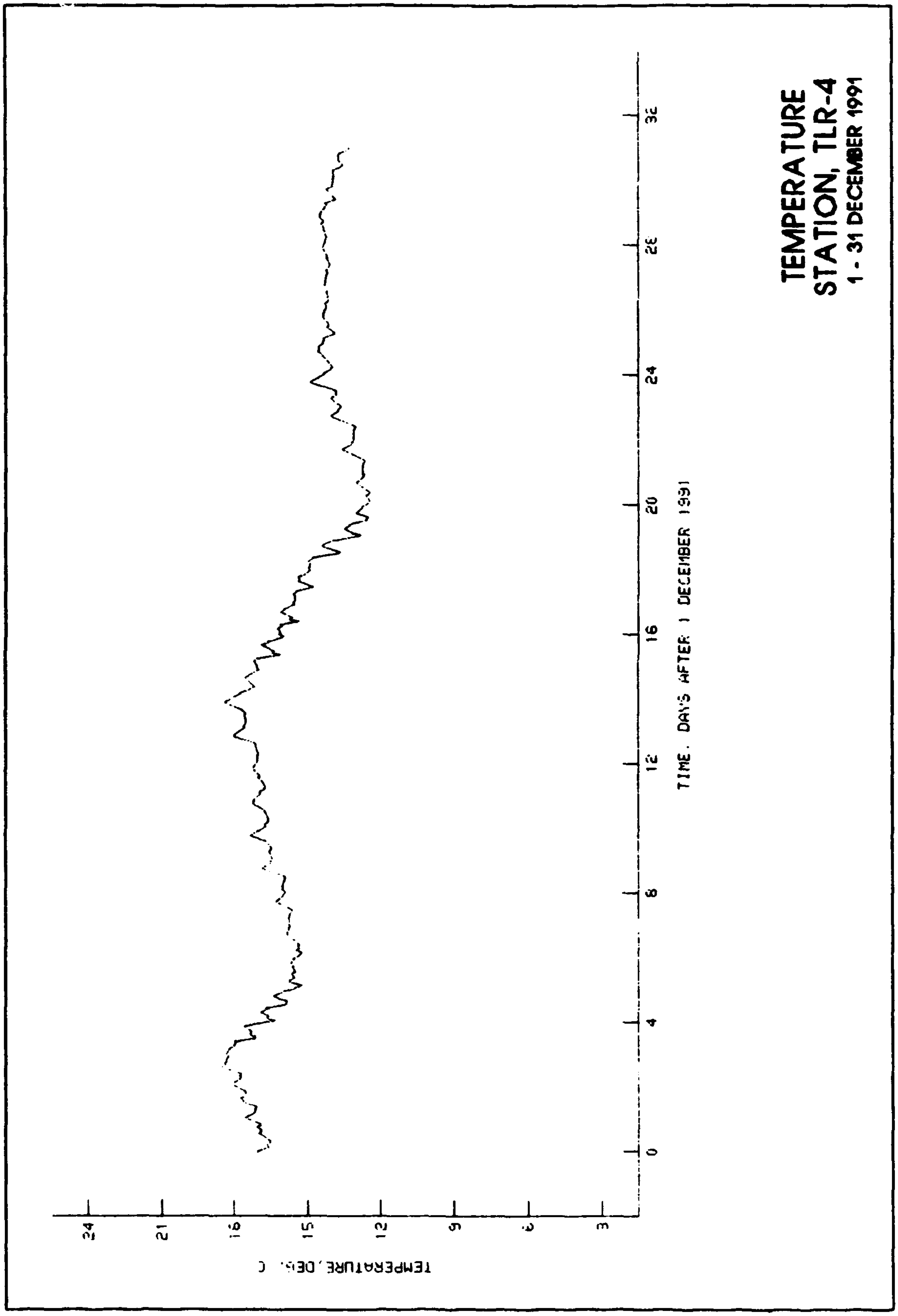
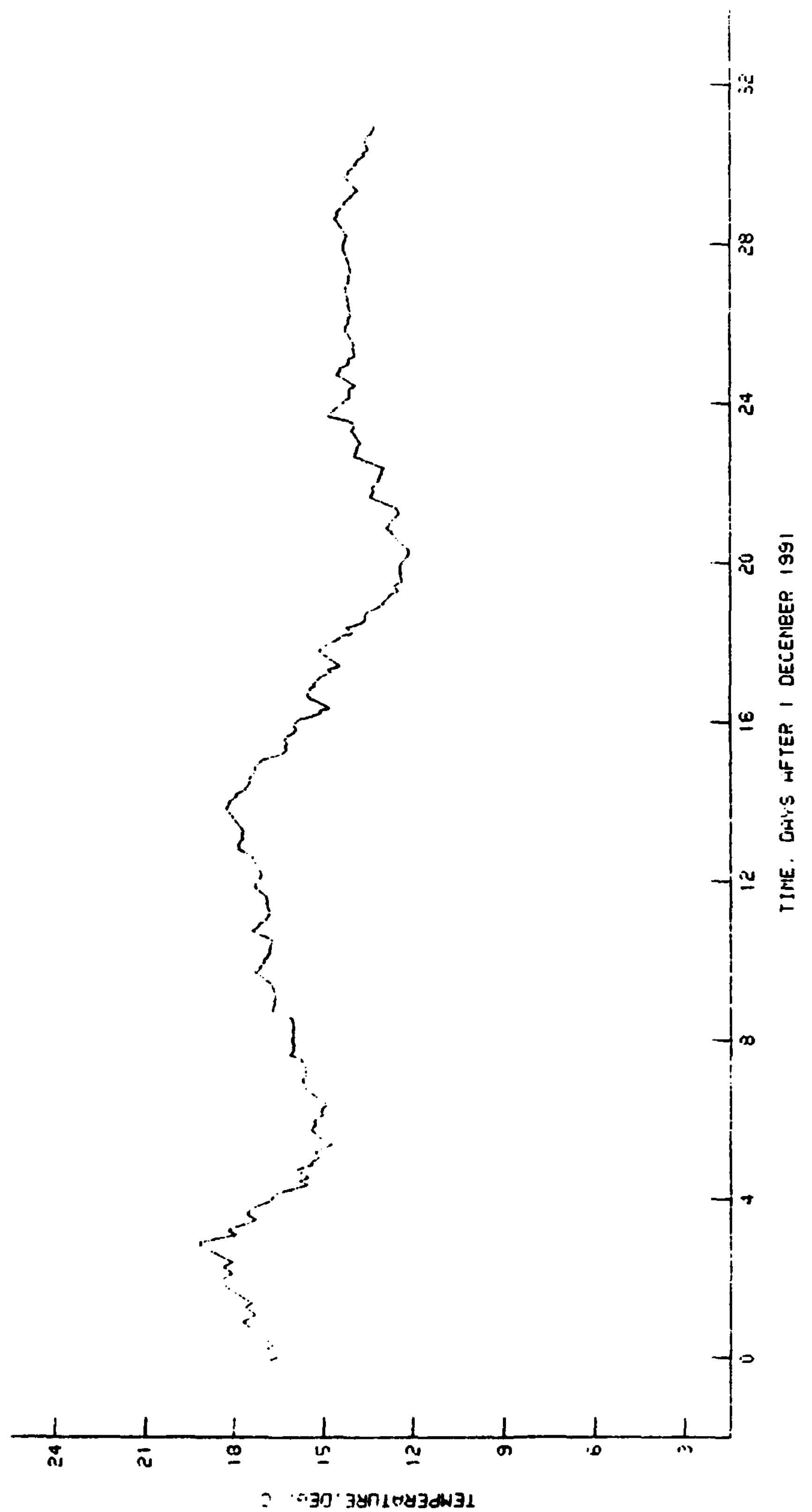

TEMPERATURE
STATION, TLR-4
1 - 31 DECEMBER 1991
TIME, DAYS AFTER 1 DECEMBER 1991
TEMPERATURE, DEG. C
0
4
8
12
16
20
24
28
32
3
6
9
12
15
18
21
24

PLATE 28



TEMPERATURE
STATION, TLR-5
1 - 31 DECEMBER 1991

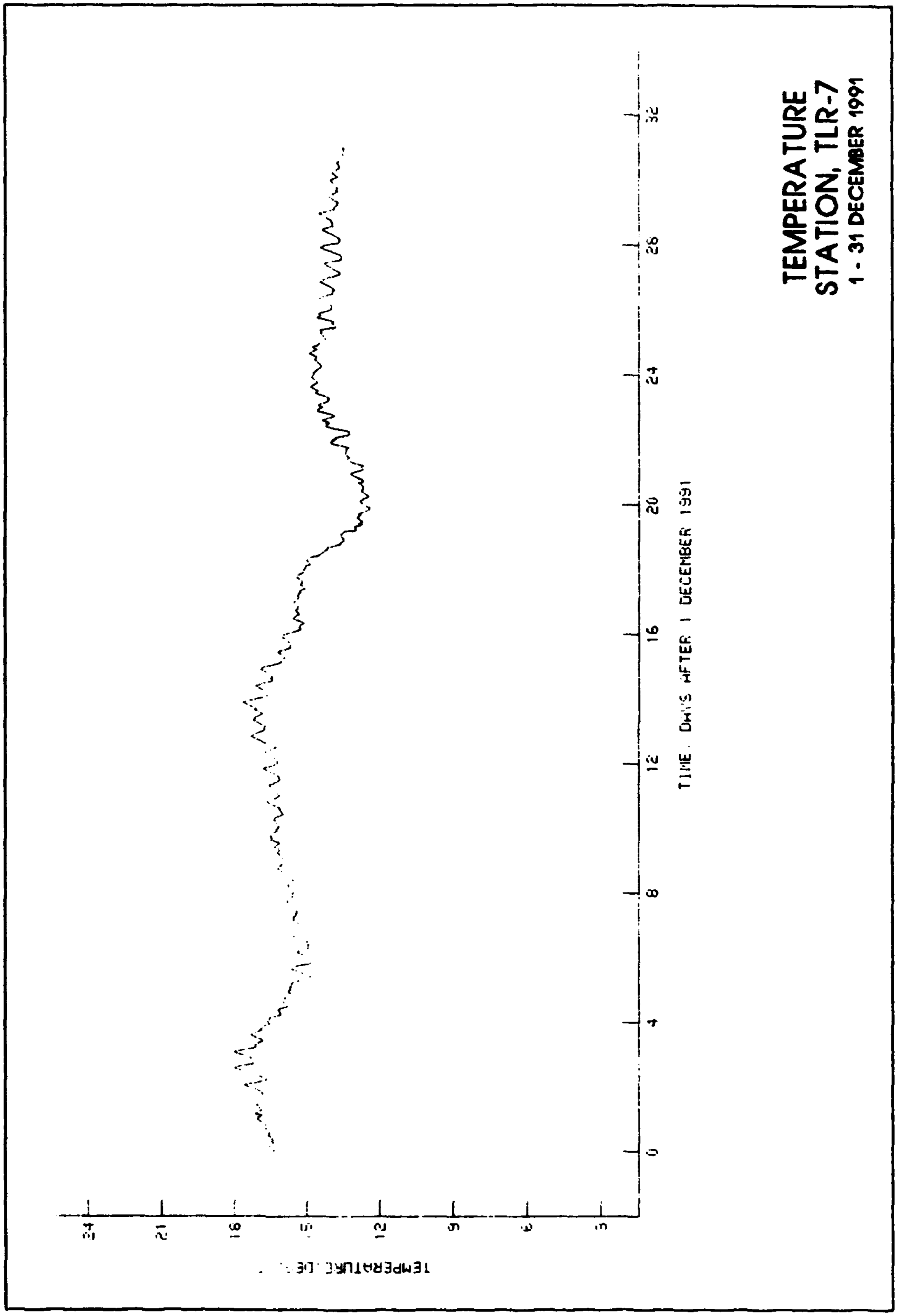
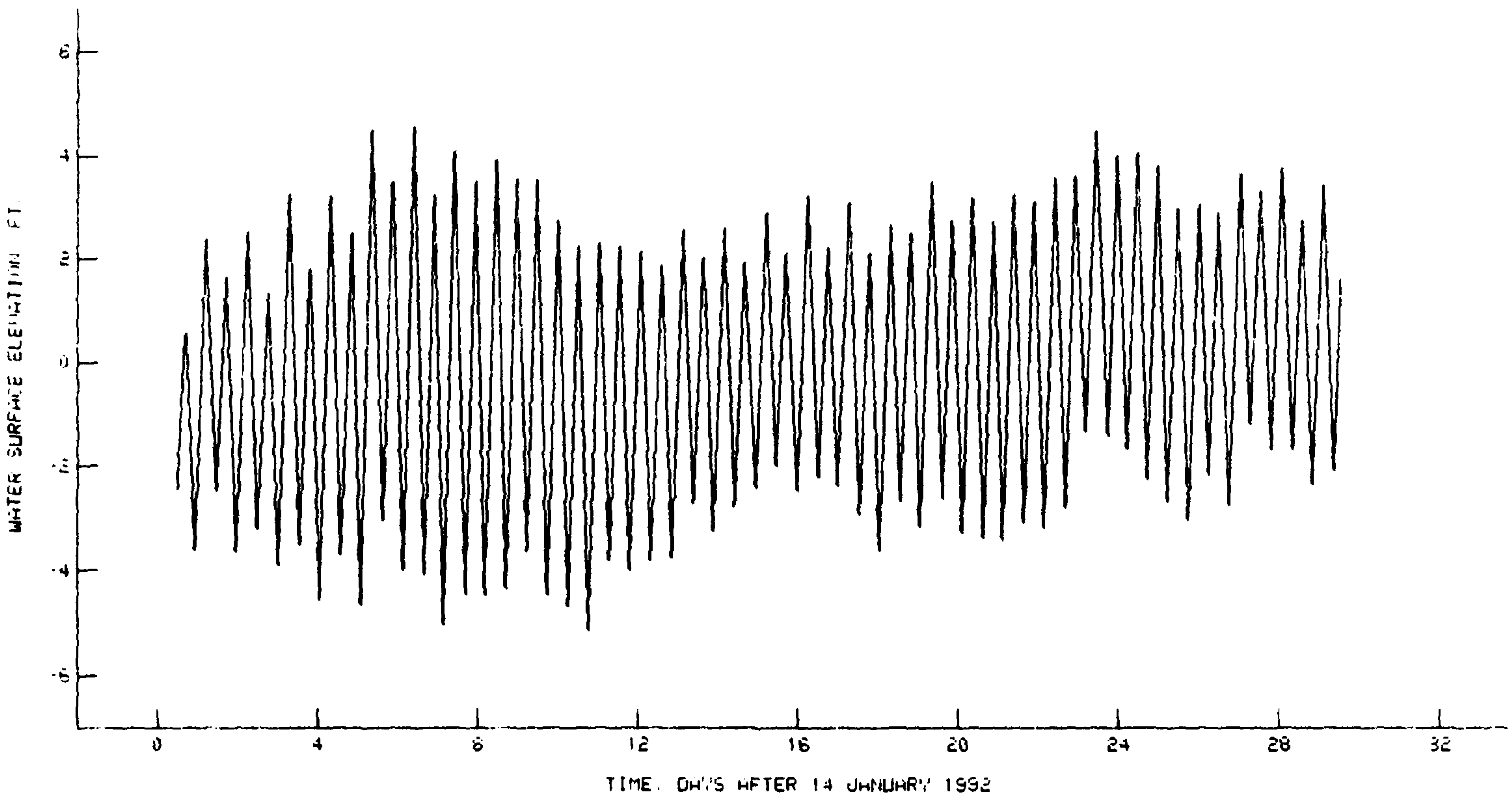
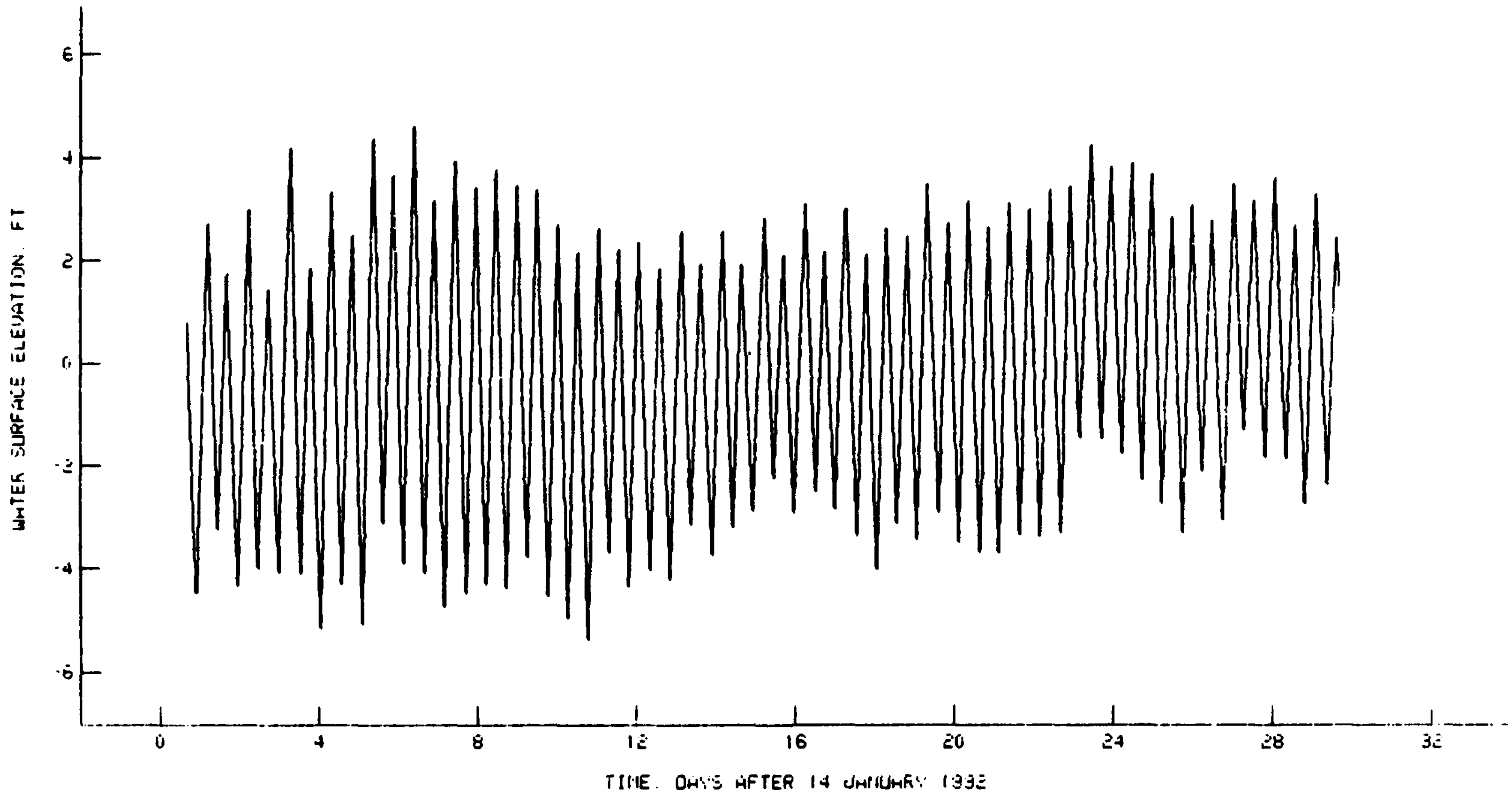

TEMPERATURE
STATION, TLR-7
1 - 31 DECEMBER 1991
TIME, DAYS AFTER 1 DECEMBER 1991
0
4
8
12
16
20
24
28
32
3
6
9
12
15
18
21
24

PLATE 30



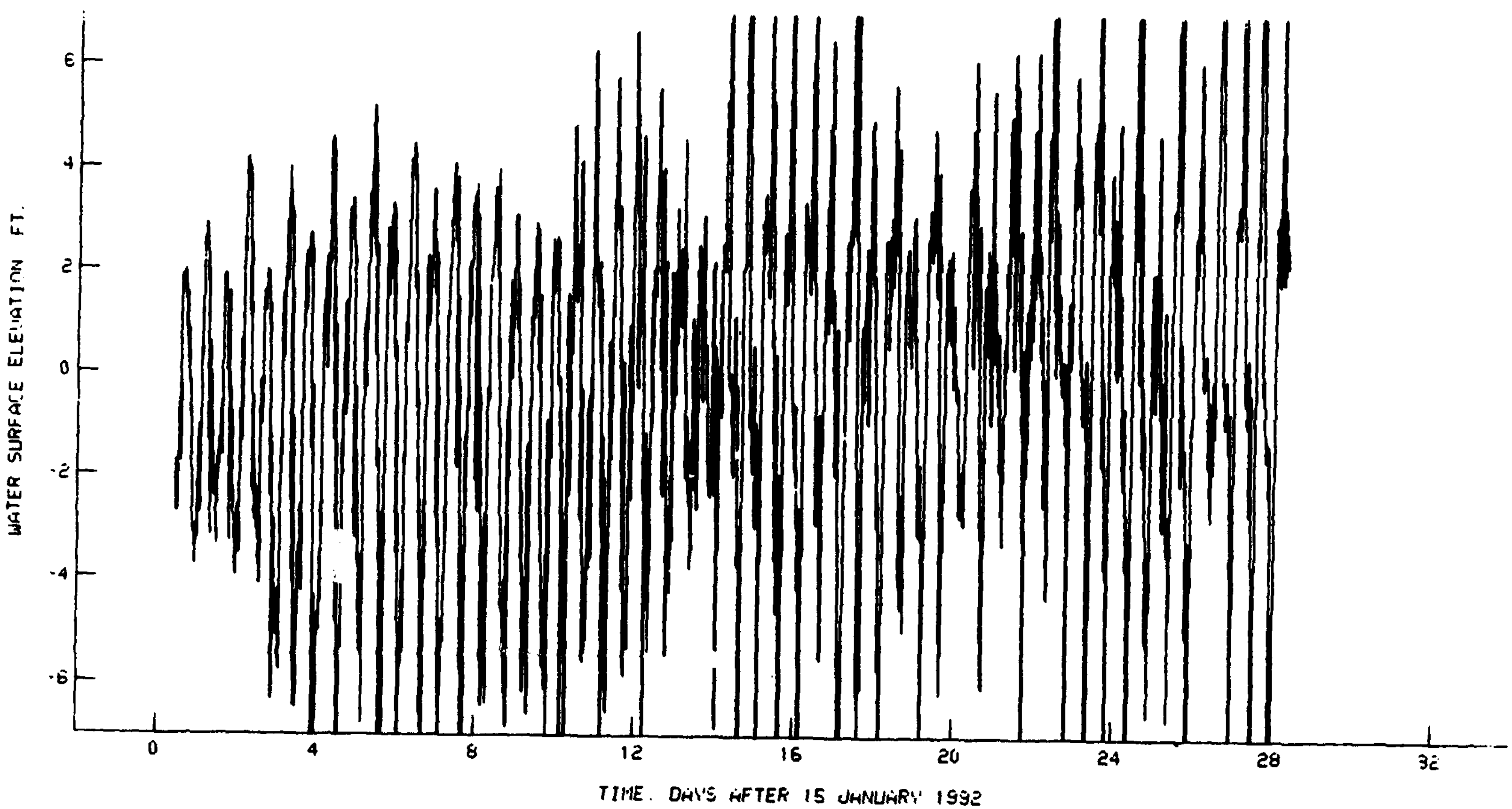
MEAN DATUM IS 3.74 FT MLW

WATER SURFACE ELEVATION, TLR-4
14 JANUARY - 12 FEBRUARY 1992



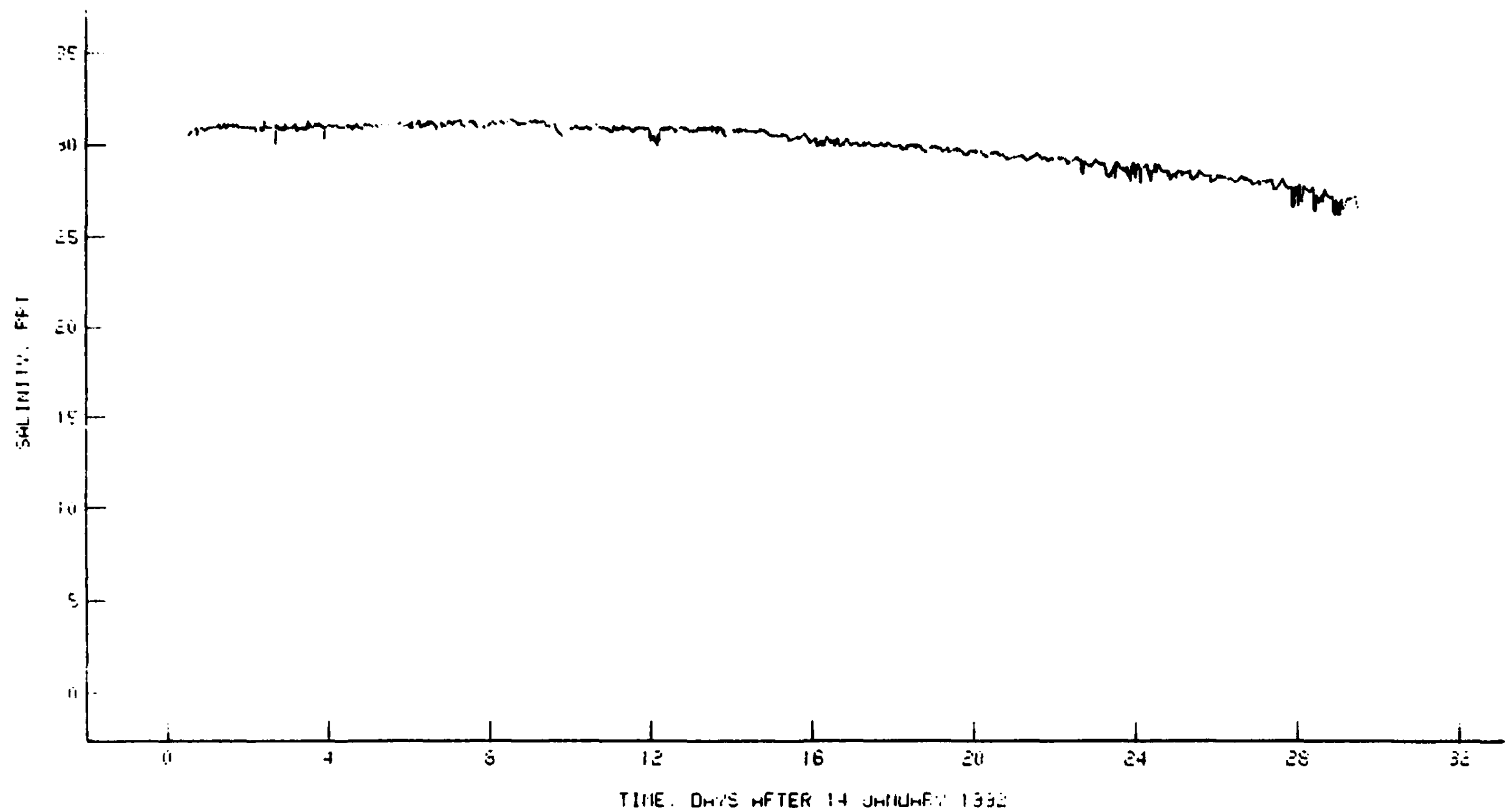
MEAN DATUM IS 1.84 FT MLW

WATER SURFACE ELEVATION, TLR-5
14 JANUARY - 12 FEBRUARY 1992

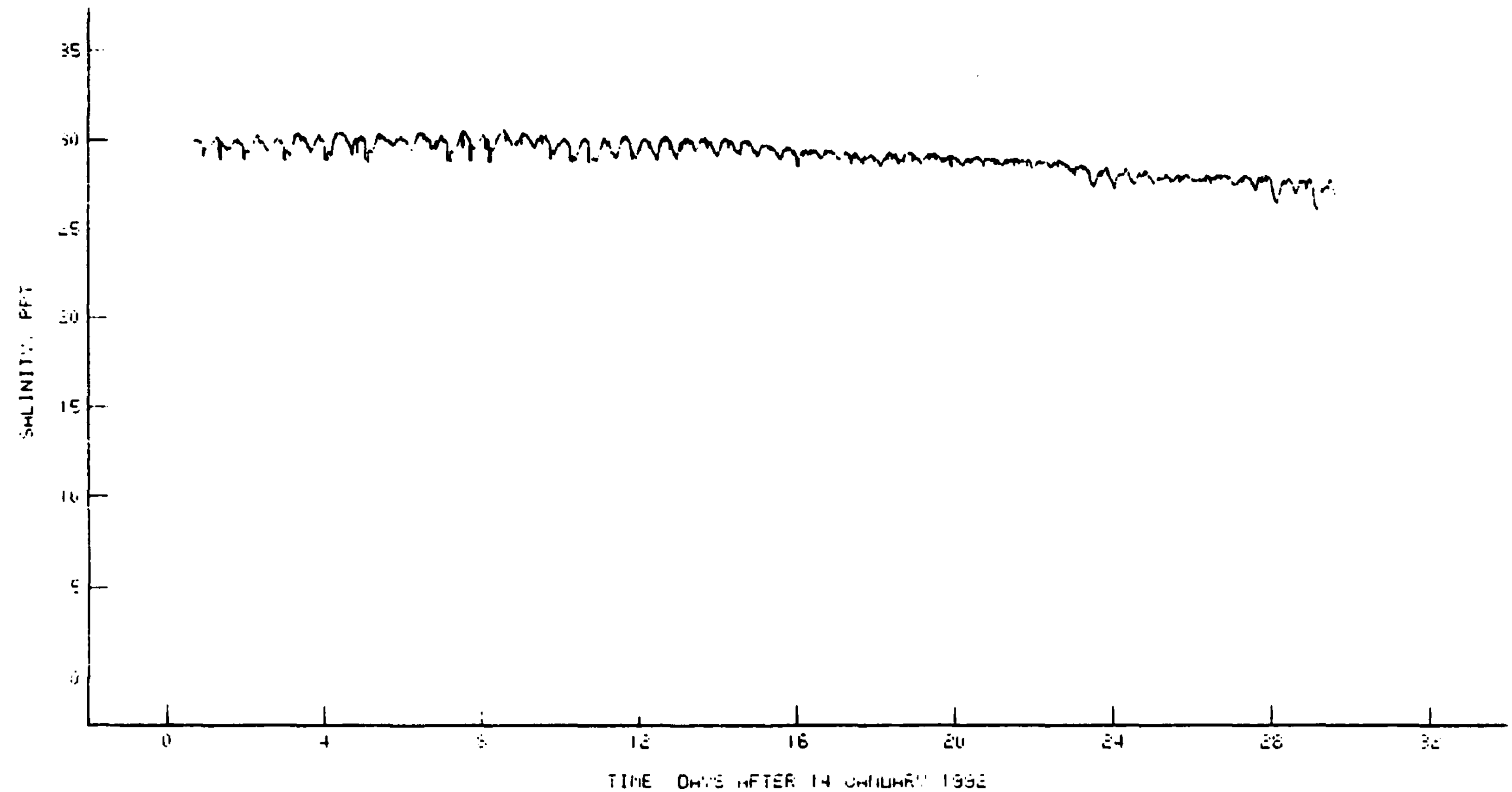


MEAN DATUM IS 3.36 FT. MLW

WATER SURFACE ELEVATION, TLR-7
15 JANUARY - 12 FEBRUARY 1992



SALINITY
STATION, TLR-4
14 JANUARY - 12 FEBRUARY 1992



SALINITY
STATION, TLR-5
14 JANUARY - 12 FEBRUARY 1992

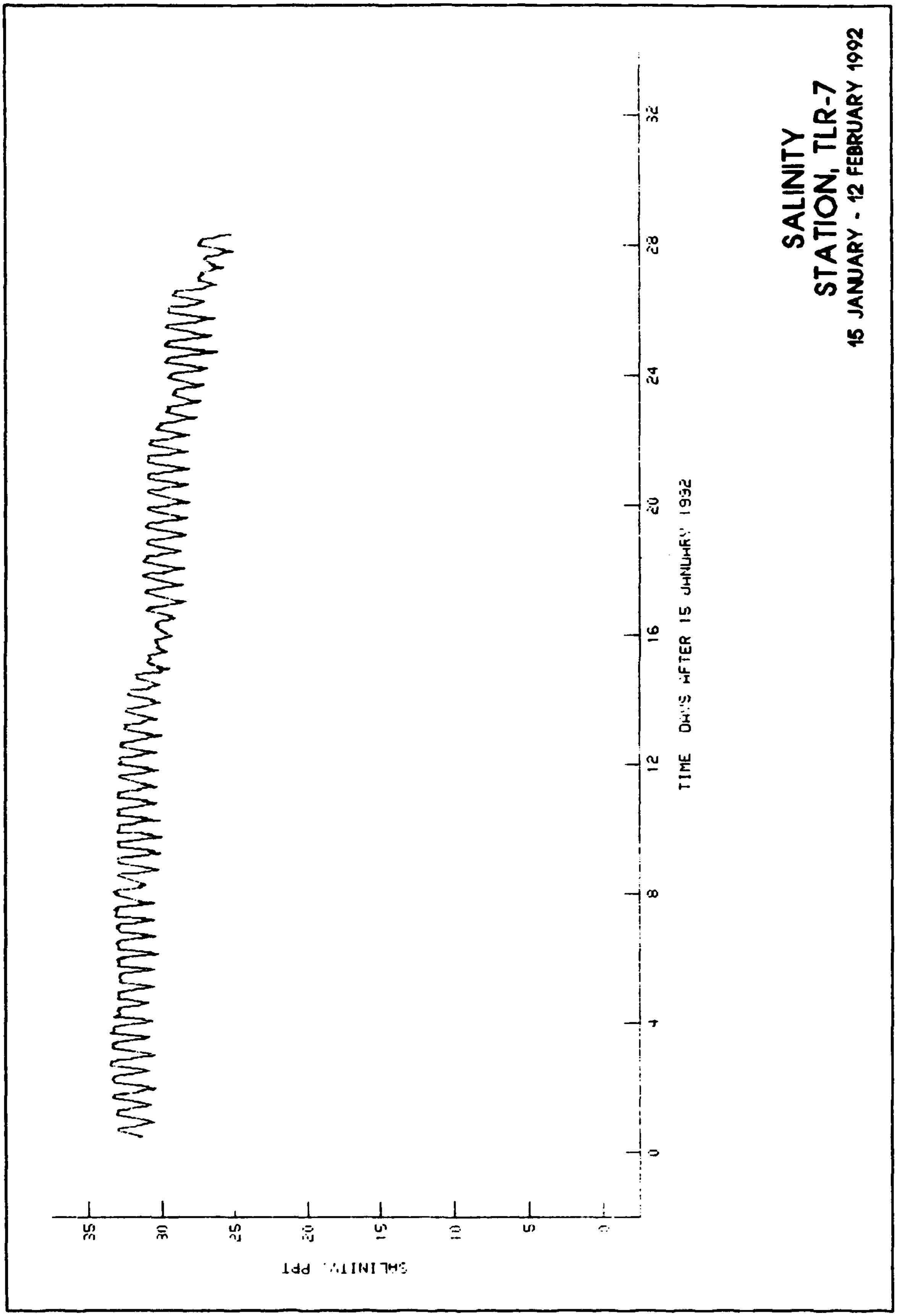
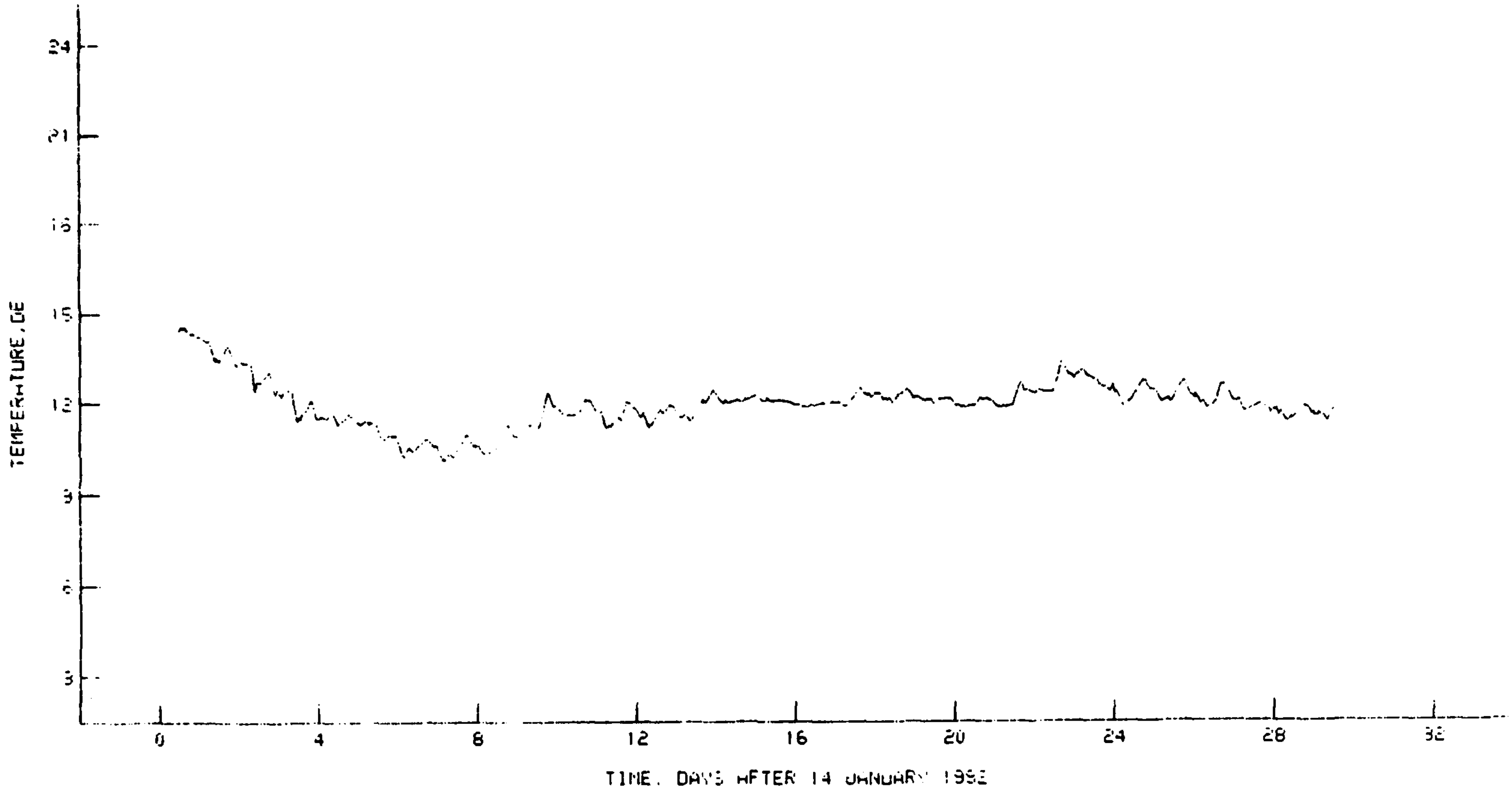
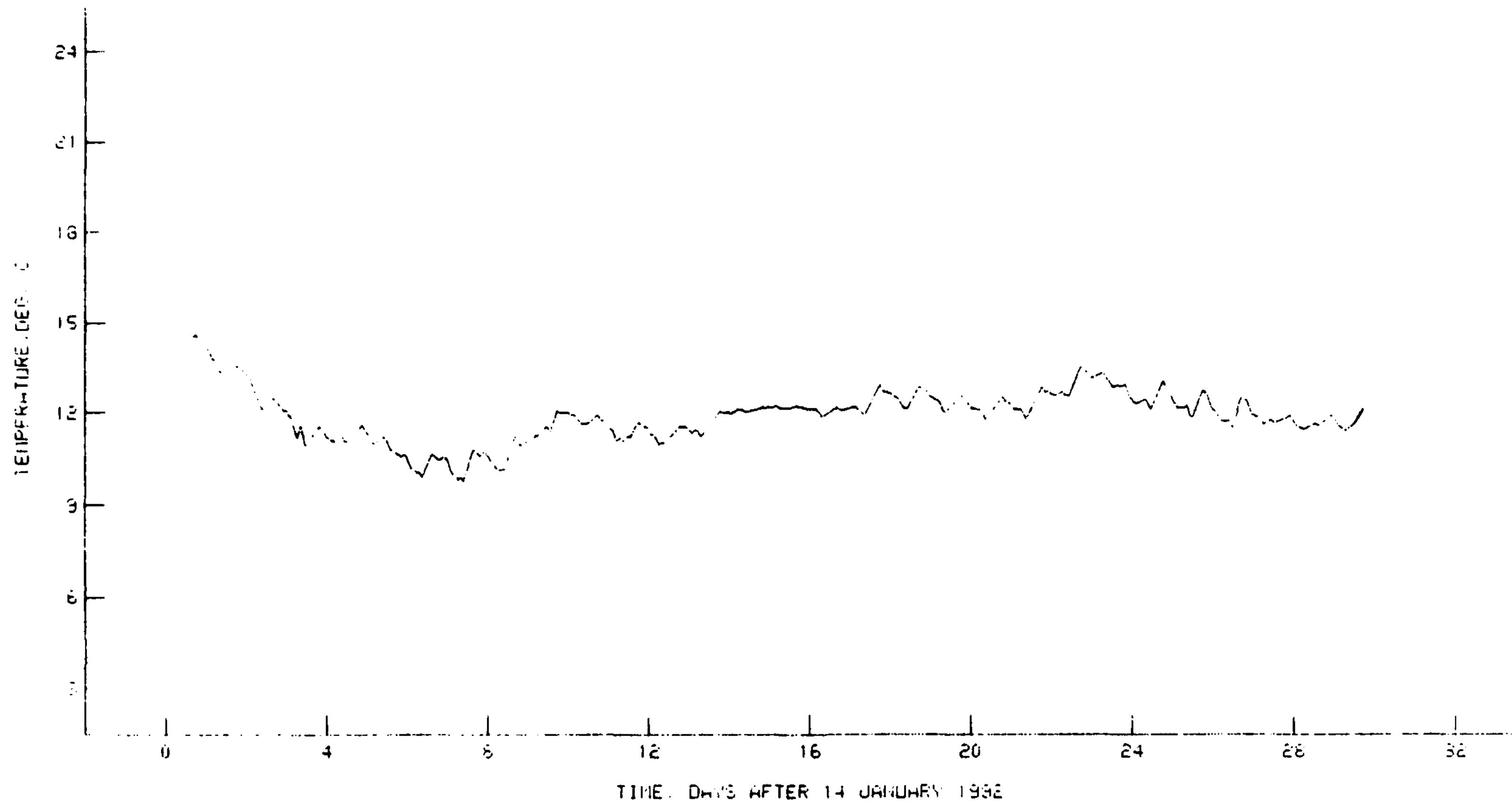

SALINITY
STATION, TLR-7
15 JANUARY - 12 FEBRUARY 1992
TIME DAYS AFTER 15 JANUARY 1992
SALINITY, PPT
0
4
8
12
16
20
24
28
32
0
5
10
15
20
25
30
35

PLATE 36

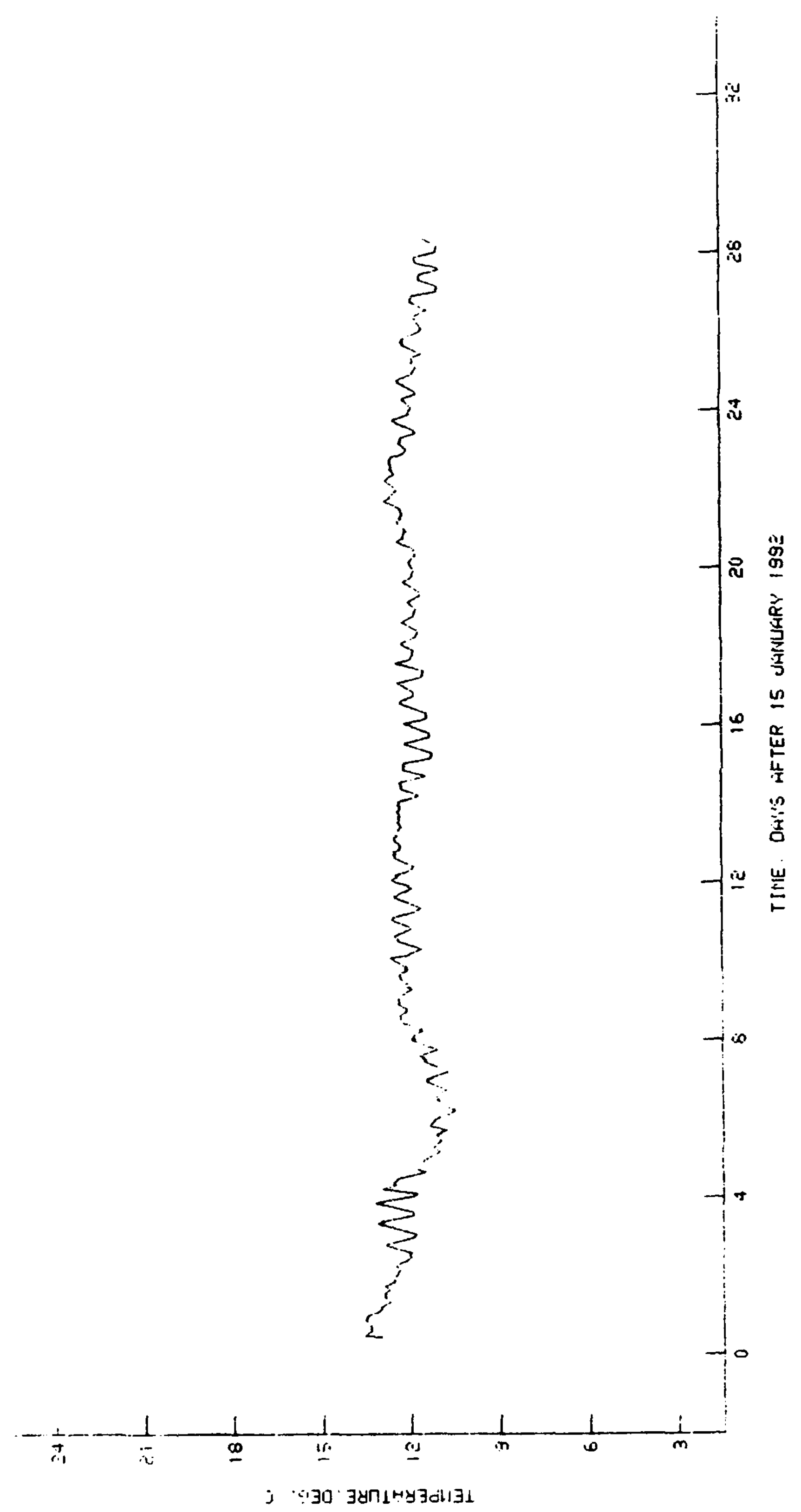


TEMPERATURE
STATION, TLR-4
14 JANUARY - 12 FEBRUARY 1992



TEMPERATURE
STATION, TLR-5
14 JANUARY - 12 FEBRUARY 1992

PLATE 38



TEMPERATURE
STATION, TLR-7
15 JANUARY - 12 FEBRUARY 1992

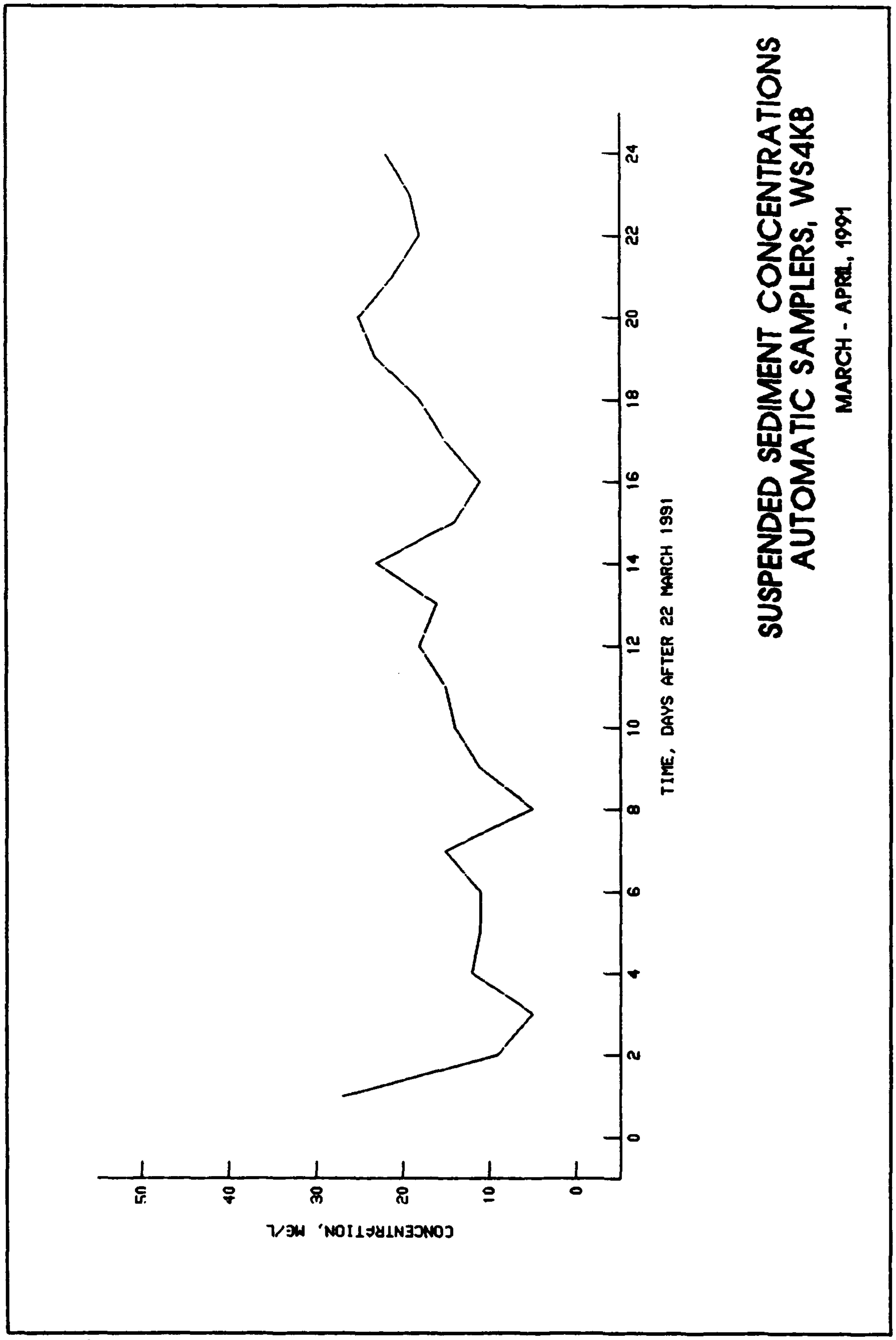
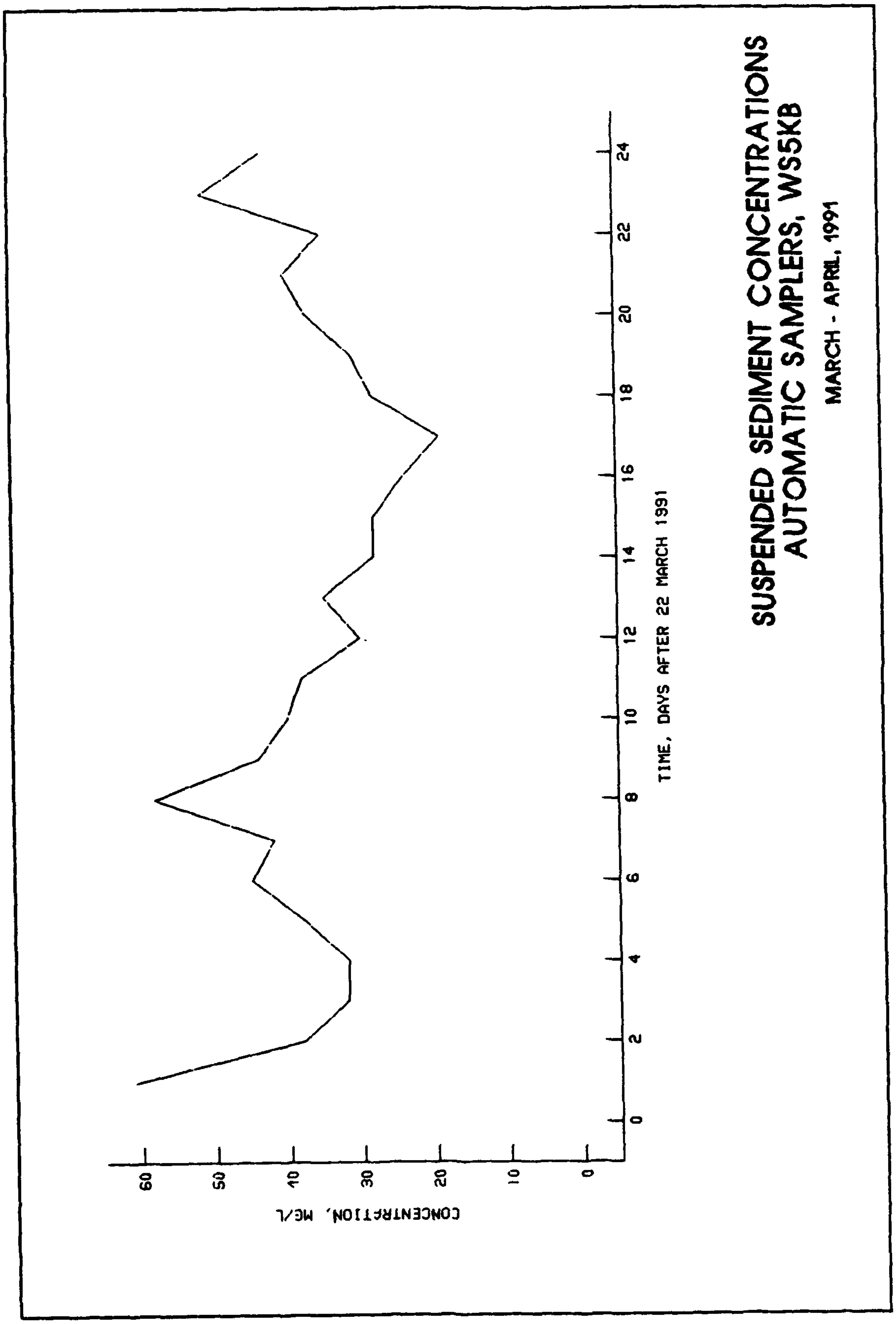
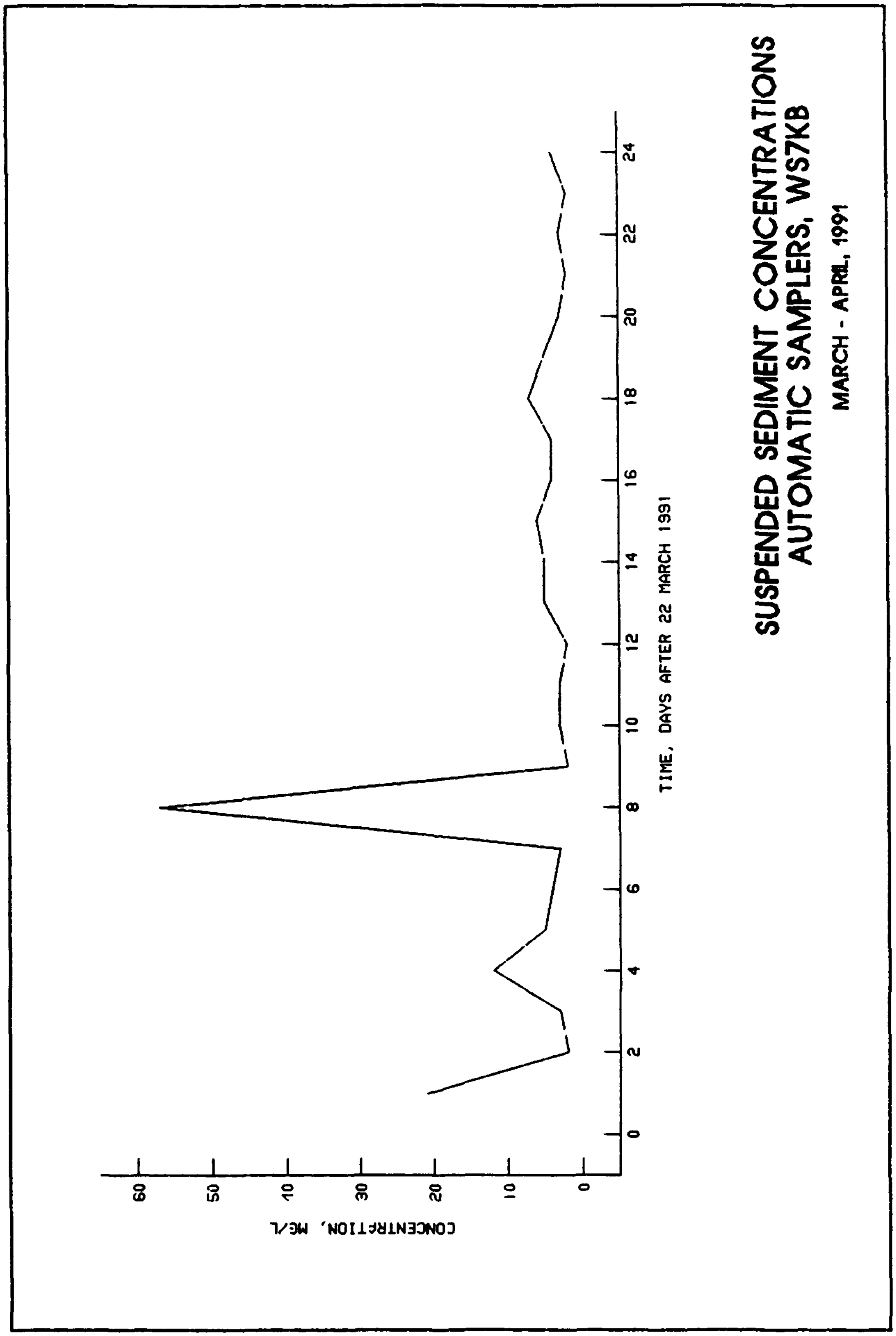

SUSPENDED SEDIMENT CONCENTRATIONS
AUTOMATIC SAMPLERS, WS4KB
MARCH - APRIL, 1991
TIME, DAYS AFTER 22 MARCH 1991
CONCENTRATION, MG/L
0
2
4
6
8
10
12
14
16
18
20
22
24
0
10
20
30
40
50

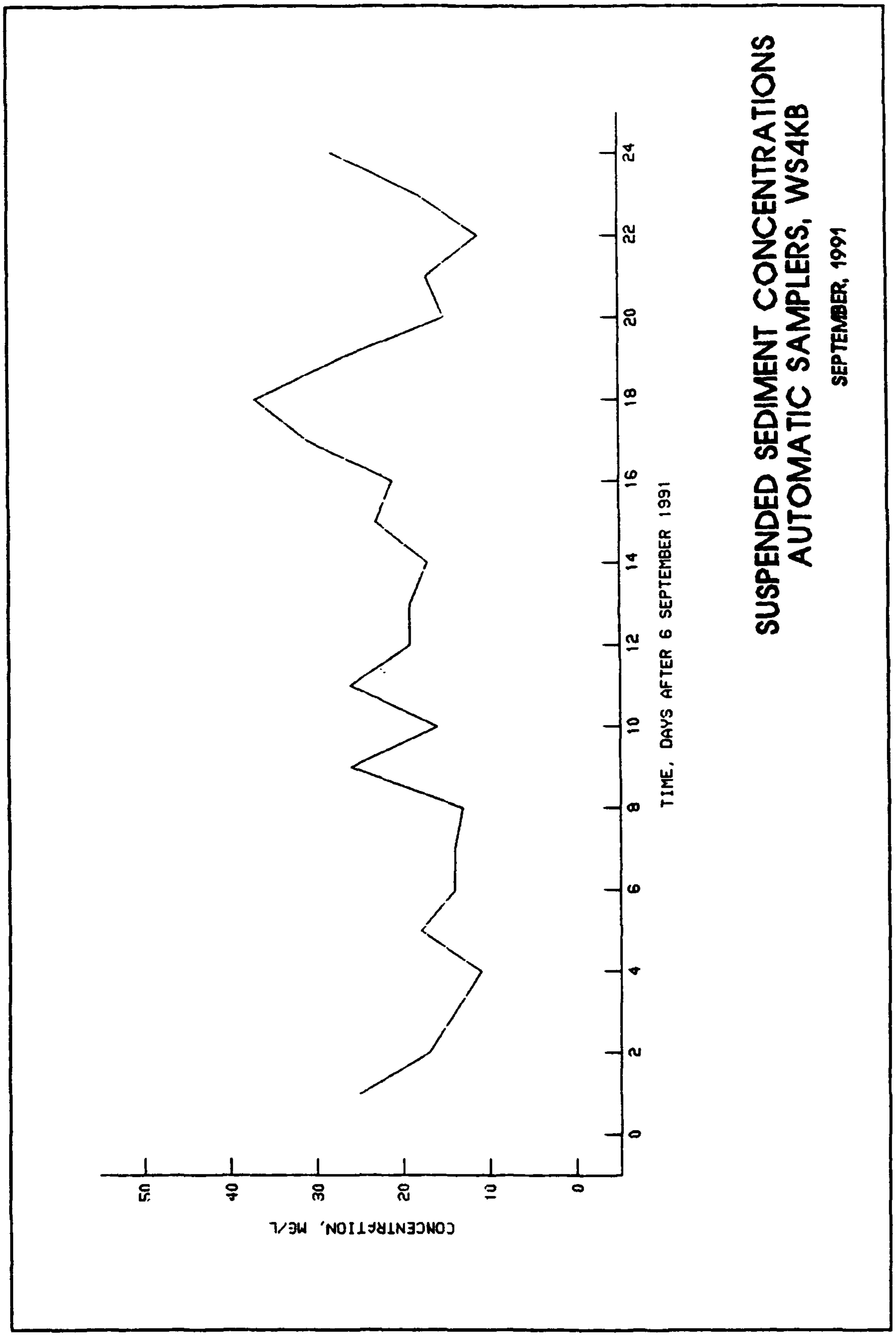
PLATE 40

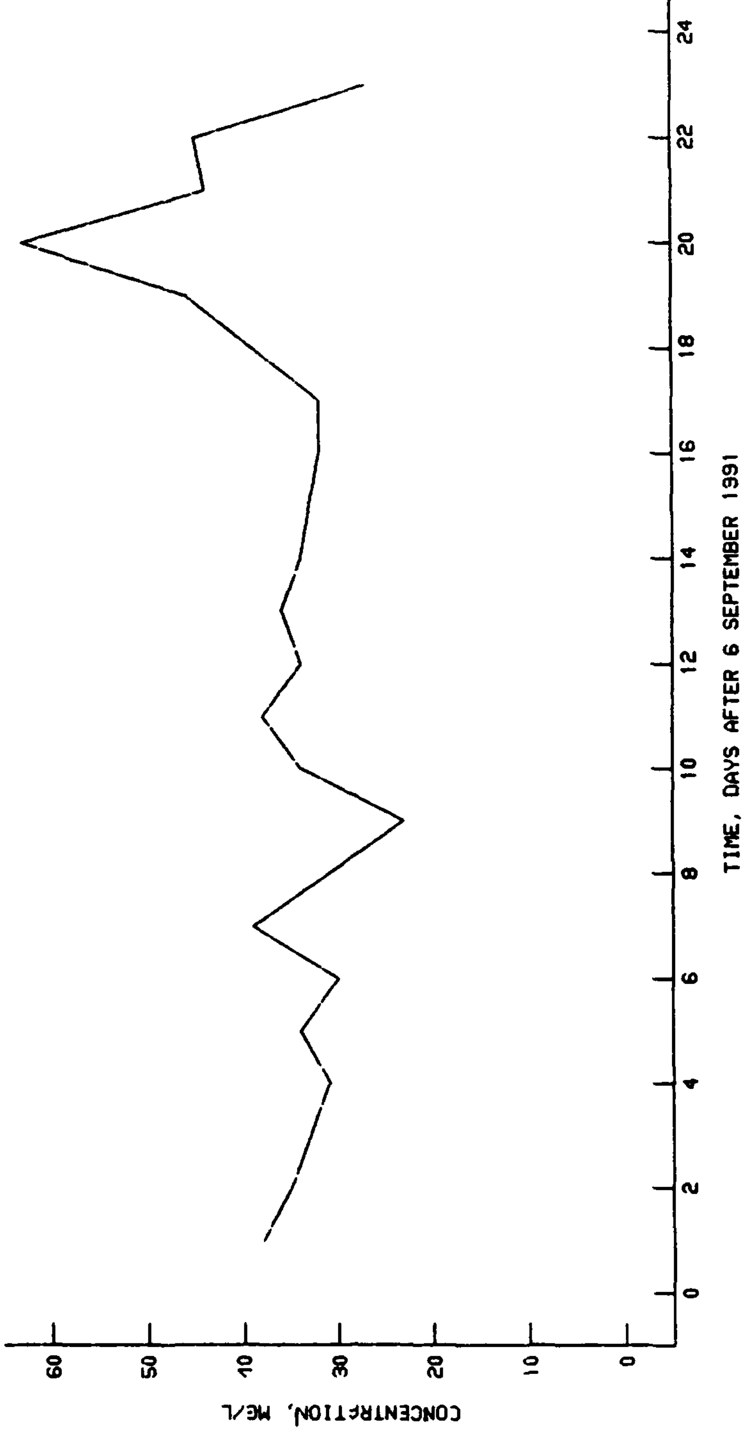

SUSPENDED SEDIMENT CONCENTRATIONS
AUTOMATIC SAMPLERS, WS5KB
MARCH - APRIL, 1991
TIME, DAYS AFTER 22 MARCH 1991
CONCENTRATION, MG/L
0
10
20
30
40
50
60
0
2
4
6
8
10
12
14
16
18
20
22
24



SUSPENDED SEDIMENT CONCENTRATIONS
AUTOMATIC SAMPLERS, WS7KB
MARCH - APRIL, 1991

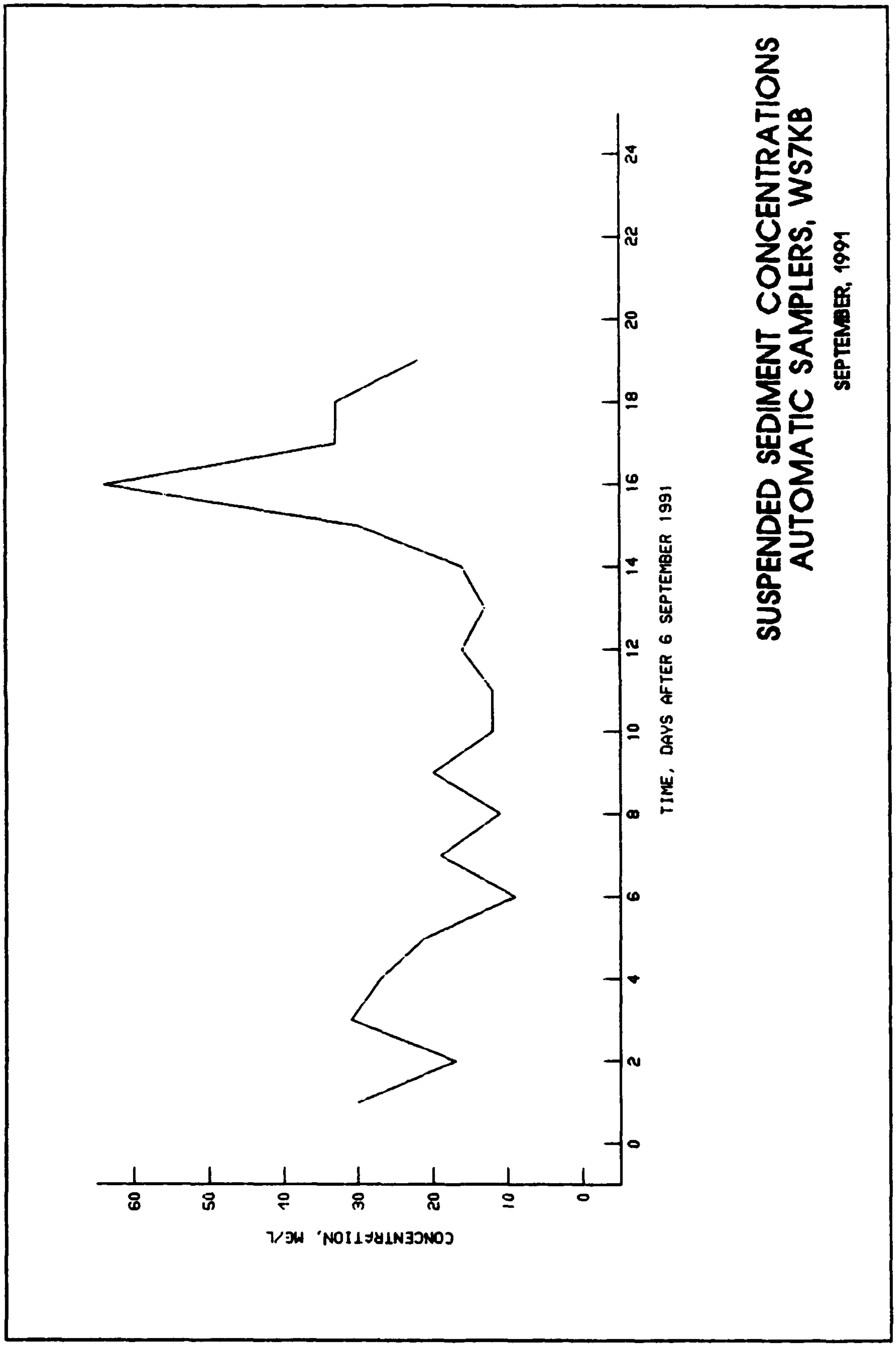
PLATE 42

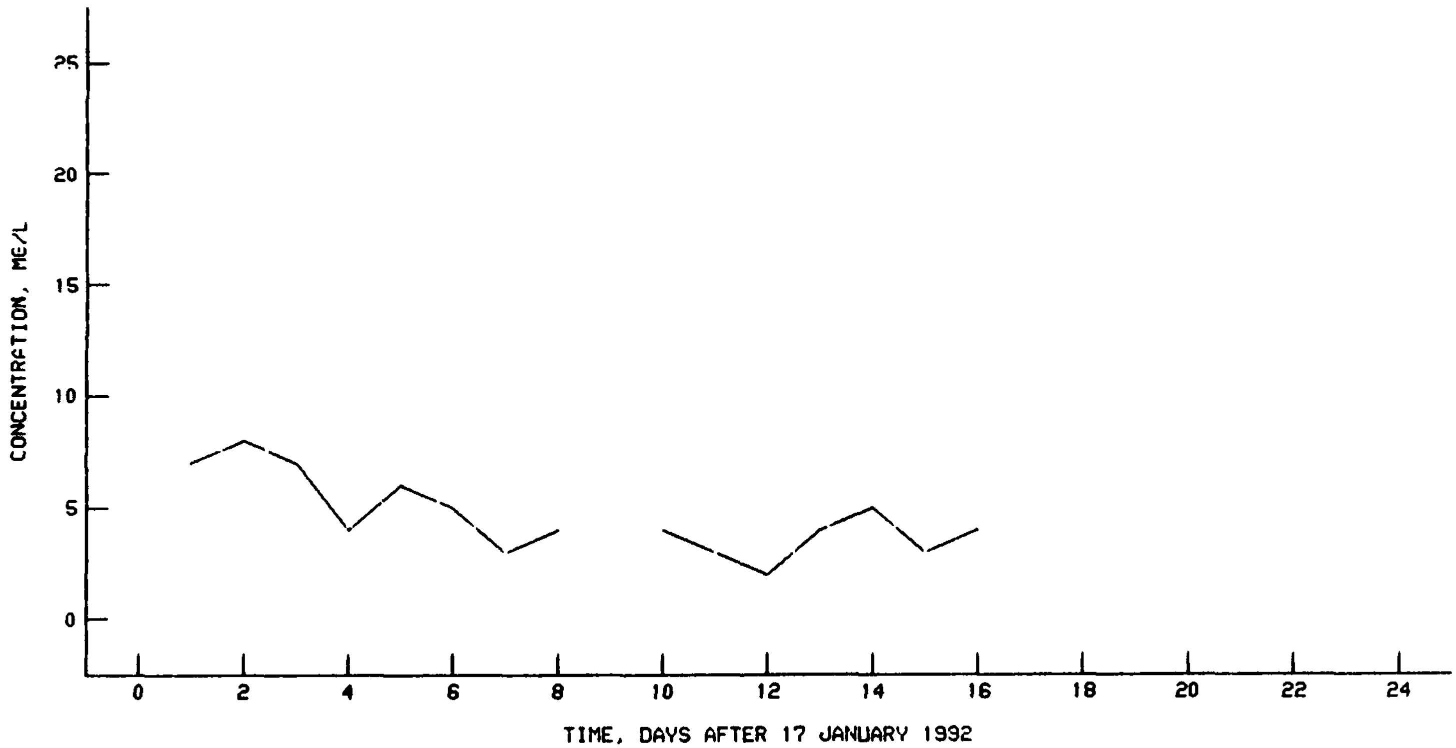

SUSPENDED SEDIMENT CONCENTRATIONS
AUTOMATIC SAMPLERS, WS4KB
SEPTEMBER, 1991
TIME, DAYS AFTER 6 SEPTEMBER 1991
CONCENTRATION, MG/L
0
2
4
6
8
10
12
14
16
18
20
22
24
0
10
20
30
40
50



SUSPENDED SEDIMENT CONCENTRATIONS
AUTOMATIC SAMPLERS, WS5KB
SEPTEMBER, 1991

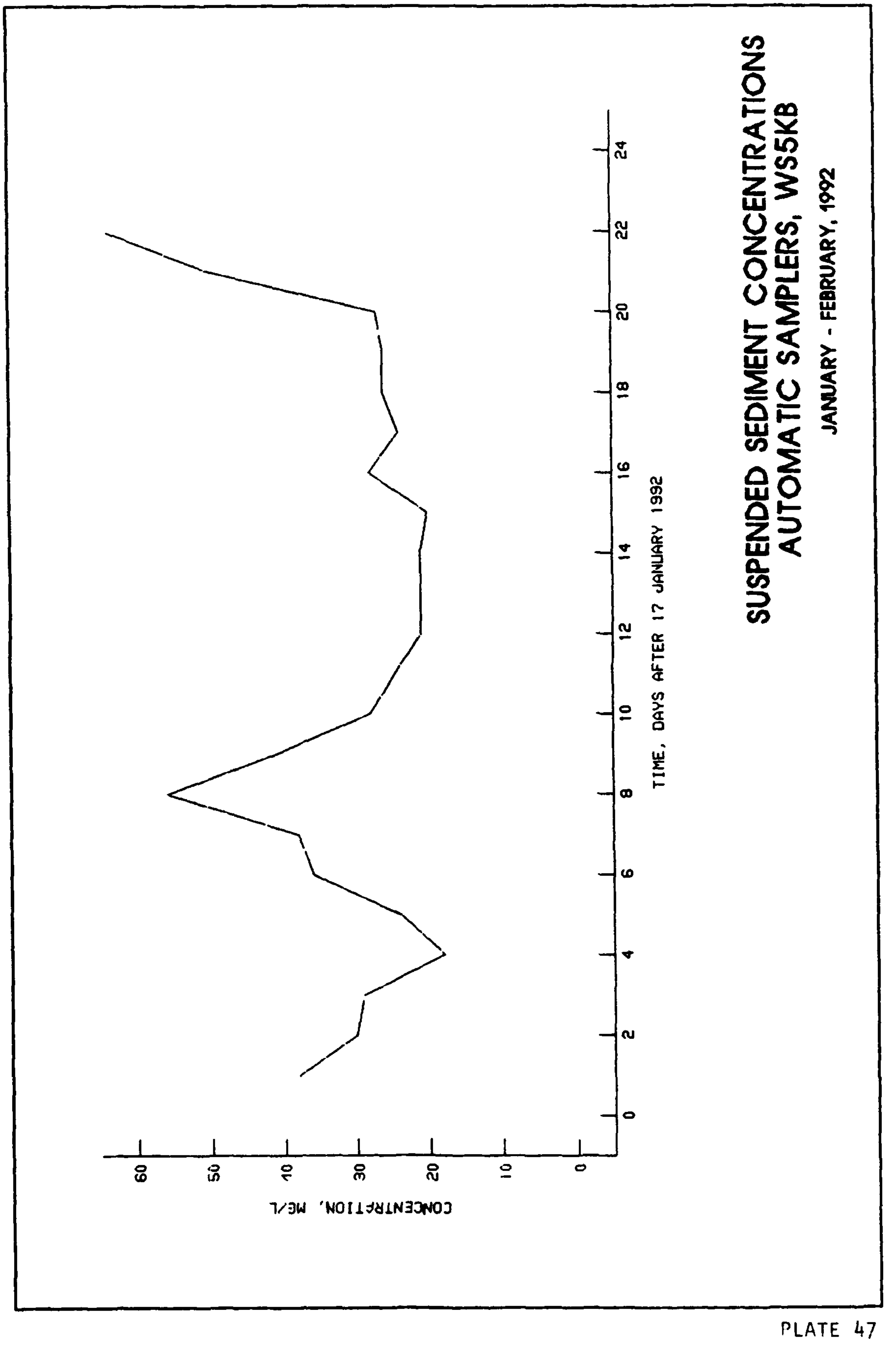
PLATE 44


SUSPENDED SEDIMENT CONCENTRATIONS
AUTOMATIC SAMPLERS, WS7KB
SEPTEMBER, 1991
TIME, DAYS AFTER 6 SEPTEMBER 1991
CONCENTRATION, MG/L
0
10
20
30
40
50
60
0
2
4
6
8
10
12
14
16
18
20
22
24



SUSPENDED SEDIMENT CONCENTRATIONS
AUTOMATIC SAMPLERS, WS4KB

JANUARY - FEBRUARY, 1992


SUSPENDED SEDIMENT CONCENTRATIONS
AUTOMATIC SAMPLERS, WS5KB
JANUARY - FEBRUARY, 1992
CONCENTRATION, MG/L
TIME, DAYS AFTER 17 JANUARY 1992
0
10
20
30
40
50
60
0
2
4
6
8
10
12
14
16
18
20
22
24

Waterways Experiment Station Cataloging-in-Publication Data

Fagerburg, Timothy L.

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TA7 W34 no.HL-91-4 rept.4